FARMERS DIGEST

NOV 25 1940
U. S. Department of Agriculture

DECEMBER, 1940

Volume 4
Number 8

25c a Copy
$2.00 a Year

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The Farmer's Digest

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The Farmers Digest

Published Monthly at Ambler, Pennsylvania

25c a Copy *1 Year $2.00*

2 Years $3.50 *3 Years $5.00*

Foreign and Canadian Subscriptions $2.50 a Year

Entered as second-class matter at the Post Office at Ambler, Pa., May 5, 1937, under act of March 3, 1879

The Farmer's Digest

Volume 4 December, 1940 Number 8

The Dairy Cow Can Take It!

Condensed from Successful Farming

Walter J. Hunt

THE dairy cow can take it! The notion that she is thin-skinned and in winter must, for reasons of health and profitable production, be coddled and shielded in a snug, warm building, is open to question. So argue experimenters at the North Dakota Agricultural Experiment Station where a closely supervised project has been conducted to find out whether or not cows really are as delicate as commonly supposed.

The experiment pretty well indicates that a warm barn is of more benefit to the man who does the milking than to the cows. If cows, ordinarily well-nourished, have shelter from the wind, snow, and rain, and have a dry place to bed down, the North Dakota people say that they'll not be bothered by cold. Production will be affected very little; feed requirements will be no greater, and probably somewhat less, than for cows of comparable milk and butterfat production pampered in a warm stable.

All this isn't as radical as it may seem. Beef-cattle growers have observed that the value of elaborate shelter for fattening cattle was exaggerated, and, occasionally, practical dairymen reported good results in winter when their cows were housed loose in sheds opening on yards in which hay was fed.

As carefully determined in different experimental trials, the explanation for the favorable results seems to be that a cow on full feed produces considerable energy, evolved as heat, in excess of that required to maintain body temperature. This excess is sufficient so that production of further energy is not demanded in comparatively cold weather for the sake of generating body heat.

The North Dakota experiment compared performance of cows kept in the dairy barn with that of a similar group kept loose in a

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well-built shed having large openings onto an adjoining yard where alfalfa hay was fed in a rack. The latter group was taken to the barn and stanchioned for milkings, at which times they were fed grain and silage. Tests were conducted from October to March, inclusive. The average temperature during the test was 50.64° in the barn and 29.39° in the shed—the temperature in the shed was oftentimes below zero, of course. Average prevailing humidity was 11 points lower for the shed group than for those in the barn.

It is significant that production ran consistently about the same for both groups, with a slight edge in favor of the shed cows. The shed cows continually gained more weight advantage. Also they used less feed, required a fraction of a pound less protein per 100 pounds of milk, and used 3.4 pounds less total digestible nutrients for 100 pounds of four-percent milk produced. There were no cases of pneumonia, and shed cows didn't suffer frosted teats as much as was anticipated.

Where a shed is used, the North Dakota experiments suggest that a well-built, sanitary, warm milking room, with two to four stanchions, adjacent to the shed be provided for convenience and the milker's comfort.

The shed system requires more bedding, but less daily cleaning, than a barn. The manure-spreader can be driven into the shed at intervals to do the job at one time and the value of the manure is improved by use of the extra straw. Too, cows loose in a shed can withstand cold better and make themselves more comfortable than when kept in the customary stanchions. They will keep cleaner in the shed, and milk of high quality can be produced. Sheds are also usually more flexible than barns as to the number of animals that can be accommodated and the original cost, of course, is comparatively low.

The North Dakota people certainly do not intend that their results should be interpreted by farmers as an open invitation to jump off the deep end or throw away discretion in the selection and practice of their feeding and housing methods. North Dakota, for example, has designed a pen barn having separate milking room, with stanchions, gutter, and concrete floor embodied in it as an improvement on the shed idea. There are several suggested arrangements, but in general they provide for two different pens without stanchions to which cows have access. These pens may be open to the barn lot most of the time. Such barns may also include a calf pen, partitioned off, and a bull pen. None of the pens will need to have floors. Many of

the advantages indicated in the experiment may be realized in this type of barn, and later, if a standard type of barn is desired, the interior may be remodeled at a minimum of trouble and expense.

Ozark Flavor Booms Market for Fried Chicken

Condensed from Nation's Business

TWENTY-ONE years ago Mrs. Earl Bagby, of Benton County, Ark., bought an incubator and insisted that she could make money by raising frying chickens out of season. She sent her protesting husband over more than 100 miles of rough hill country in a horse and buggy on a search for hatching eggs. Today that same area in the Ozarks uses 100,000,000 pounds of chicken feed annually to support the industry founded by the Bagbys.

After a few years' experience the couple bought an 80 acre farm for chicken raising. Neighbors became converts to the frying-chicken industry. The nearby town of Cave Springs, population 200, became center of the industry and production mounted to quotable figures in six years. Chicago and other metropolitan markets absorbed the entire production at high prices. A nest egg of nearly $7,000,000 was laid in the laps of 1,500 farmers in 1938 and again in 1939 in parts of Benton and Washington counties or an area of about 25 square miles.

The community produces many one and one-half pound "fryers," but most of the chickens are heavier—weighing up to four pounds. A specially developed routine of care is presumed to give them exceptional tenderness for such large fowl, extra flavor appeal and fine appearance. Metropolitan markets classify them for special display under the trade name of "Arkansas White Rocks."

Surest sign that the industry is maturing is that there are already old-timers who lament the good old days of high prices. An average of 22 cents a pound is good now, with production cost around 15 cents. Most producers choose to produce in volume at lower profits.

The most successful producers start three crops yearly, have from two to twenty brooder houses and from 1,000 to 10,000 broilers per crop. Commercial

Reprinted by permission from Nation's Business, Washington, D. C., September, 1940

formulas have been found most successful for feeding. Marketing is done by buyers who ship or truck to market at their own risk. Broiler-raising requires night and day care as specialized as hospital routine and, though the profits are good, heartbreaks, long hours and failure are just as common as in any other enterprise.

Marketing of Arkansas White Rock broilers has been aided by metropolitan restaurants who feature Ozark products because the name connotes a distinctive flavor in fruit or meat. Others have found new ways to "egg on" America's taste for fried chicken. Bishop's in Tulsa heeded a columnist's plea for the right to eat fried chicken naturally by creating "Chicken in the Straw." This gourmet's dish is half a "fryer" cut for easy eating, fried and nested in French-fried potatoes, served without cutlery. Cellophane wrapping with distinctive labels is another aid.

Pigs Need Vitamins

NORMAL growth in swine requires that the pig's diet contain at least five separate vitamins and probably two more as well, according to Dr. E. H. Hughes, of the Univeristy of California College of Agriculture.

In summarizing the vitamin requirements of pigs, Dr. Hughes names vitamin A, vitamin D, thiamin, riboflavin, and nicotine acid as the substances known to be essential. The last three are members of the so-called vitamin B complex. Two other vitamins, either or both of which are probably needed, are the filtrate factor and vitamin B-6.

Scientific experimentation has not yet uncovered evidence that vitamins C and E are needed, says Dr. Hughes, but it is possible that they play some still undetermined role in the pig's nutrition.

Lack of the vitamins known to be essential produces striking symptoms in pigs. These symptoms include impaired vision, nerve degeneration, paralysis, retarded growth, muscular incoordination, and anemia. It is possible in some cases to bring the animals back to normal by adding the missing vitamins to their diet. —*Hog Breeder*

The Importance of Horses in Modern Warfare

Condensed from The Horse

Colonel Edwin N. Hardy

Chief, Army Remount Service

THE only reason for the existence of horses in an army is that they can do some things nothing else can do and can do some other things better than anything else can do them. This is true, or should be true, of any weapon or element in any army.

Recent military operations in Europe, and our increased interest in the plans for our own National defense, have caused people in all sections of the United States to inquire as to the use of horses in modern warfare. Certainly, in preparing for the future we must be guided by the experiences of ourselves and others in the past, but we must carefully analyze those experiences and guard against drawing false conclusions.

As important as has been the military mechanization of ground units in the recent successes of the German armies, we must admit that aviation contributed more to their victories than any other one factor. The decisiveness of aviation is particularly emphasized by the fact that one side —the Germans—possessed a dominant superiority. It would be difficult for any army to gain victories, no matter what comprised its ground forces, if it did not possess the benefit of something approaching equality in the air. Failure to give recent military operations the proper analysis might easily result in discrediting any ground element due to the overwhelming preponderance of German aviation.

Are we to do away with artillery because dive bombers are now performing to some extent the function of long-range artillery, or because other smaller planes are performing to some extent the functions of other classes of artillery? To accept such conclusions is unsound; it is also unsound to accept the conclusion that horses in warfare are obsolete. There will be presented evidences of their most important use in the present war by the most completely mechanized army the world has ever known. The average person does

Reprinted by permission from The Horse, Washington, D. C., Sept.-Oct., 1940

not realize the great number of horses which were used and are being used by the German army since the outbreak of the European war in September, 1939.

To go back as far as World War 1, it may be of interest to note a few factual developments with reference to the horse in warfare during the past twenty-six years in various and widely separated parts of the world:

During the World War the United States alone exported to Europe 923,580 horses and 232,475 mules. On both sides there were engaged possibly four times this number of animals, or a total of approximately 4,624,220.

In the late Civil War in Spain, Franco, with all the outside aid he received (principally mechanized), had to create finally a new balance in his forces in favor of animal elements before he could win the war. His horse cavalry alone was increased from 5 to 60 squadrons.

Italy over-rated the versatility of her mechanized forces in her war on Ethiopia and had to create a new balance in favor of all sorts and types of animals, including oxen and burros.

Japan miscalculated her balance in mechanization in her recent and present wars in Manchukuo and China. As a result, she has greatly augmented her animal components in her present armies and has provided for the future production of military horses on a large scale.

Germany for many years has been one of the leading nations of the world in producing horses for military use. Her remount service during the reign of Kaiser Wilhelm II attained a high state of development and efficiency. During the Hitler regime the remount activities of Germany have been increased.

Both England and France discarded the horse to a greater extent than did Germany. We certainly cannot attribute the victories of Germany up to the present time only to this fact; nevertheless both England and France were active last fall in this country in the procurement of horses and mules for their military forces.

Below are extracts from an article, "The Horse in Poland," from the October, 1939, issue of *Sankt Georg*, a German magazine:

"All cavalry will be interested in the part which the horse played on the German side in the Polish campaign. In this connection we may state without any exaggeration that the rapid advance of the German army would have been impossible without the horse, and furthermore, horses proved their worth in the manner that was expected. To be sure, the significance of the motorized and mechanized forces is

unquestionable, but cavalry formations * * * moved at almost the same rate of speed. Each of our infantry regiments has approximately 500 horses and most of our artillery is horsedrawn. In accordance with the communications of the headquarters staff of the Wehrmacht in its report dealing with the campaign in Poland, five armies took part in the great decision. According to this, we may assume * * * that Germany used more than 200,000 horses in the campaign in Poland and that this large number made possible the pace of advance of the attacking armies."

The report of the German headquarters staff dealing with the campaign recognized horse cavalry in a special manner by saying:

"Division commanders expressed particular appreciation of the activity of their cavalry in their reports to the Fuehrer, who was on the battlefield with his soldiers. We also have reports of conspicuous cavalry action by separate squadrons. As an example, a squadron in the South Army, led by a well-known race horse rider, boldly attacked a Polish battery set up on difficult terrain (in a great vineyard, rising terrace-like) and captured it. The losses were small in spite of a direct hit within the squadron.

"When the weather (which during the main was extremely favorable and did not offer any obstacles to the advance of the motorized and mechanized units) became bad during the final concluding operations, cavalry and horse-drawn battalions came more into their own."

The Polish campaign was followed in the spring by the crushing and swift defeat of the Allies in the campaigns in Flanders and France. While aviation and mechanized ground forces still maintained their dominant role, we should not overlook the fact that the German armies used even more horses in the latter campaigns than in Poland. In the campaigns in Flanders and France, the German armies included 791,000 horses. Horses are still used because they can still perform some functions nothing else can perform and can still do some things better than anything else can do them.

The composition of an army depends in great measure upon the theatre of operations in which that army will be used. It seems improbable that any army of the United States will be used on foreign soil outside of the western hemisphere. If we ever go to war, our theatre of operations will probably be in the western hemisphere, but it would be difficult to attempt a prognostication as to the exact theatre of operations in that vast area. Let it suffice to say that the differ-

ences in terrain and climate existing in that great area, and the many undeveloped sections therein, will offer more opportunities for the use of horses and mules in warfare than in closely organized and highly developed countries similar to those in which the present European war is being fought.

I would like to call attention to the fact that whatever horses we use in war must be produced in time of peace. The production of these horses, therefore, is the first mission of the United States Army Remount Service. I believe that we in America know better how to use horses in war, especially in cavalry action, than any other nation.

The horse has proven one of the ablest and most ancient allies of man, in peace or war—no matter whether his master was savage or civilized—no matter the language he spoke, the God he worshipped or the climate or land in which he lived. Is it any wonder then that those whose duty it is to make a decision look back on history and the recent past with no assurance that our dependency on the horse in war is at an end?

The Cost of Removing Mature Apple Trees and Orchard Replacement

Condensed from American Fruit Grower

EVERY grower who has been in this business of producing fruit for any length of time has faced the possibility of replacing an orchard or portion of an orchard. When trees reach an age where their fruit is so low in quality and quantity that it doesn't bring money enough to pay for their care, let alone a profit on working investment, it's time to move in with tractor and chain.

Although thousands of growers have pulled trees, and have replanted with new and improved types on sturdier stocks, there's hardly one in a thousand who wouldn't hesitate in answering this question:

"What would you say, offhand, it cost you to pull out the old orchard and set that new block of trees?"

C. L. Burkholder and H. S. Hall, of the Purdue University Agricultural Experiment Station, kept accurate cost records on the removal of 340 trees in a 40-acre 40-year-old orchard at the sta-

tion's Bedford (Ind.) farm this year. Their figures reveal, probably for the first time, just what it costs to take out trees, recondition the land and get a young orchard started, including a cover crop.

Contrary to what would naturally be expected, cost of actually pulling the 340 old trees was a small part of the total expense, running just $20.80. All of the trees were pulled out in a day, using a tractor, driver and four helpers. Largest of the cost items was for trimming and sawing up the trees and pulling away and discarding of tree crowns, amounting to $205.80. Tree removal and land leveling, which included filling stump holes and disking, ran the cost to $25.96 per acre or a total of $233.65 after deduction of $75 realized from the sale of 75 cords of wood.

Other items, such as hauling, spreading and purchase of 24 tons of limestone, drilling and cost of two tons of commercial fertilizer, purchase of 335 trees for replanting, digging holes, hauling in black dirt, replanting, seed and application of seed, brought the total cost to $529.20 or $58.80 per acre, allowing credit of $75 for the 75 cords of wood.

Tractor hours used on this job were paid for at the rate of 60 cents for the small tractor and $1.50 per hour for the large tractor that pulled trees. Man hours were listed at 20 cents each, team hours at 45 cents and other items at cost.

Burkholder and Hall have this to say about their practical project:

". . . Sales returns indicate that during the period 1930-1938 inclusive, this area of 340 trees had gone 'in the red' at the rate of about $1.25 per tree per year, or that the rest of the orchard had to make up a deficit of $3,825. . . . When figured from this angle, the investment of $1.55 to pull out one of these old trees, level, fertilize and replant a young tree becomes an entirely different picture."

They appropriately ask, "Do you have an area of worn-out 'loafers' in your orchard. If you have, isn't it about time to hold court and bring condemnation proceedings!"

Concrete Feeding Floors Cut Production Costs

Condensed from The Ohio Farmer

FOR hog production to be a profitable business feeders have found it necessary to give attention to details of sanitation, and also to stop the leaks in feed loss. If the hog is fed on the ground or on any but a hard surface, much of the feed is pushed underfoot and is wasted. Many feeders have found a hard-surface floor a good investment.

The question of where and how a feeding floor should be constructed immediately comes to mind.

Where the ground is firm and well drained, concrete may be laid directly upon the soil after such perishable matter as grass, roots and general rubbish have been removed and the area has been graded and firmly compacted.

The proper mixture for a concrete feeding floor is five gallons of water per sack of cement, using sand and pebbles in an average wet condition. If these materials are quite dry, a one sack batch will require six gallons of water. For a trial batch, use one part cement, 2¼ parts sand and three parts pebbles. If necessary, vary the amount of sand and pebbles to secure a smooth, workable mixture, but do not change the amount of mixing water per sack of cement.

Farmers' Bulletin 1480 makes the following statement regarding forms: "Usually two-inch lumber of the width equal to the thickness of the concrete slab is used for the forms, although one-inch lumber will serve if it is well staked and braced to prevent bulging."

The floor should be sloped in at least one direction so it will drain well after rains. Sunshine and rain will keep the surface clean. A slope of ¼ inch to a foot is sufficient.

If a large feeding floor is being built, it is advisable to lay it in slabs, each slab being ten feet square. A good plan is to lay the alternate slabs first and the intermediate ones later. The joints between slabs should extend clear thru the slab.

A curb or apron six inches thick and extending four inches above the floor surface will prevent the hogs from pushing the grain off the floor when feeding. This curb should extend 12 inches or more below ground level so

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that the hogs will not root underneath the floor.

If the surface is finished with a wood trowel, a gritty surface will be secured and there will be no danger of the hogs slipping when the floor is wet. A four-inch floor of 300 square feet requires 24 sacks of cement, 2¼ cubic yards of pebbles. A floor of this size will accommodate 30 hogs.

Each 10 lineal feet of curb or apron requires 2¼ sacks of cement, 4½ cubic feet of sand and 6¾ cubic feet of pebbles.

A few hours after concrete has been finished, the work must be protected by a covering of moist earth or similar material kept wet by sprinkling for about a week. Then the covering may be removed and the floor put into use. Wagons should not be driven over it, however, until it is at least three weeks old.

Complete details on construction can be found in U. S. Department of Agriculture, Washington, D. C., Farmers' Bulletin No. 1480.

Pneumatic Tires

TWO manure-spreaders, one equipped with pneumatic tires, the other with steel wheels, were pulled behind a tractor at Iowa State College for 1,000 miles under fall, spring, and winter conditions. Each machine was loaded with 4,000 pounds of gravel. Drawn for 200 miles at 2.05 miles per hour and for 600 miles at 10 miles per hour, the rubber-tired spreader ran smoothly even over rough roads. During the 1,000 miles only five nuts were loosened. On the steel-wheeled spreader, under identical conditions, 11 parts were broken, five were lost, 15 were loosened, one was bent, the rear wheels were replaced, spokes were loosened, and the second set of rear wheels and the sideboards were worn down one-eighth of an inch by the shifting gravel. The front axles were deformed 3.4 times as much with steel wheels as with rubber, and the front bearings were worn down 2.2 times as much in size. Furthermore, the rubber-tired machine required only 44 percent as much draft as the steel-wheeled one, meaning that four horses could pull as heavy a load on rubber as nine could on steel. Thus the lowly manure-spreader wins the luxury of pneumatic tires on purely economic grounds.—L. C., Iowa.

—*Successful Farming*

Feeding the Beef Herd

Condensed from The Rural New-Yorker

R. W. Duck

THE statement is often made that the only return from a beef breeding cow is her calf. This is true only if considered on the basis of immediate compensation. Favorable and influencing factors in a beef production program are, low cost of maintenance for the breeding herd, and the comparative favorable market selling price for old or non-breeding, good conditioned beef cows. Most important of all, feeder calves produced from either grade or registered beef cows of good type, and sired by a registered Hereford, Aberdeen, Angus, or Scotch Shorthorn bull are superior-doing feeders. Calves so produced can seldom be purchased at any price on local eastern markets, because breeders usually find it more profitable to grow and fatten them at home. At the terminal markets well bred beef calves of good type and conformation may be purchased, especially in the Fall and early Winter, as they are sold from the western range country. However, their price, transportation, and handling is usually above production cost, which is another important factor in favor of home raised feeders.

While it is true that the calf is the only direct immediate return from the beef breeding cow, there are several other considerations in a beef breeding and production program which cannot be ignored. Suitability of the farm, availability to a good market, kind and price of the land, area available, type of livestock farming desired, amount of capital to invest, and general conditions must all be carefully studied if success is to be attained. It will require from one to three acres of permanent fair grazing acreage in grass to carry a cow and calf during the Summer. Additional acreage will be required for the needed production of hay, silage and grain to finish the steers, and winter the breeding herd. A beef breeding herd may and usually should be operated as a side-line to fruit, poultry, dairy and other types of farming.

After weaning, the beef calf is on its own as a production operation, but profit and loss on the entire project will be largely determined by the efficiency and economy of gain made by the home raised feeders. One of the larger breeders in the East once told me that his establishment

Reprinted by permission from The Rural New-Yorker, New York City, October 5, 1940

over a period of ten years had figured that an average net profit of $10 per cow was satisfactory for their commercial herd. They charged against the cow her proportionate overhead and cost of feed at market price, which was all home raised, thus giving a profitable easy market outlet for all their home raised hay and silage, and thereby increasing total farm profit operations. However, the cows had to pay their way as mentioned and received a credit on the books for the value of their calves at weaning time, which left an average net profit of $10 per cow.

Let us consider some possible suitable and adequate beef breeding cow rations and calculate their annual cost at various prices. My observations based on many visits to experiment stations, as well as range and farm contacts and operations, lead me to believe that one and one-half tons of good quality hay or its equivalent in other roughage will adequately maintain a beef breeding cow in good condition during a wintering period of six to seven months. Assuming an average pasture season of six months gives a fair basis for computing costs.

Experiments at both the Montana and Utah Stations show that beef breeding cows may be successfully wintered on an average of about 20 or somewhat less pounds of alfalfa hay per head daily. Cost may be materially reduced by utilizing some corn stover or straw to replace part of the hay ration. It was further demonstrated in the Montana trials that oat hay was superior to alfalfa hay for wintering beef breeding cows. Kansas and Ohio Station investigators have shown that it may be more efficient and economical to replace part of the dry roughage with corn silage. If so used it has been demonstrated that 30 lbs. of silage and 5 lbs. of legume hay fed daily will prove satisfactory. When stover (corn stalks), straw or prairie hay is fed alone or with corn silage the daily addition of 1 lb. of protein supplement is needed.

Tests at various experiment stations have shown the advisability of using mixed protein supplements both for fattening steers and for the beef breeding herd. Director Paul Gerlaugh, Ohio Experiment Station, Wooster, did some especially valuable initial work along this line of investigation. I remember on one of my visits there he was just about two-thirds through his first test relative to feeding dry-rendered tankage and various protein mixtures to some two year old steers. He remarked that some probably thought him crazy trying to feed tankage to steers, but the important thing was that the tankage fed group made the

most efficient and economical gains, and outsold the other test steers.

Mixed protein supplements have been proven preferable to one alone. Price per ton and per 100 pounds of digestible crude protein would constitute the determining factors in making such purchases and mixtures. Suggested protein supplemental mixtures which have been used with success include, equal parts cottonseed meal and linseed meal, or various combinations of these with soy bean meal, corn gluten meal, and dry-rendered tankage.

Availability and possible net selling or purchase price are the determining factors relative to the kind of roughage ration it will be most profitable and economical to use with the beef breeding herd. As an illustration let us figure alfalfa hay at $15 per ton and corn silage at $5 per ton, then based on amounts and rations previously mentioned, for a period of 180 days, their respective total feed costs per cow would be $27 and $20.25. With straw at $5, if 15 lbs. is used with 10 lbs. of alfalfa the feed cost would be the same as with silage and alfalfa.

Several tests at various experiment stations have shown that it is more economical both from a land area consideration and cost of feed to use either sorghum or corn silage instead of their respective fodders. Such fodders, however, may be used if lack of silo or availability makes them desirable with good results, provided they are supplemented with about one pound of protein supplement per head daily. Oat mill feed has a value comparable to grass hay and almost as much as timothy hay. If it can be purchased at or below the roughage prices mentioned its use is beneficial and economical. Dilute molasses may be used on it to good advantage to make a low cost ration. The stovers and straws may also be used more completely and efficiently by the addition of from one to two quarts of molasses per head daily. With these last mentioned low cost roughages and molasses the use of one pound of protein supplement per head daily is especially desirable, otherwise the nutritive ratio of the feeds used will be too deficient in digestible protein.

Regardless of the wintering roughage used it has been found advisable and profitable to provide beef breeding cows as well as all other classes of livestock with constant access to a suitable mineral mixture. One which breeders and feeders have found to be especially satisfactory consists of iodized stock salt 200 lbs., ground limestone 100 lbs., and steamed bone meal 100 lbs.

Beef calves offer the maximum in return for their required minimum of care and attention. It is

customary and more profitable in most beef breeding herds to have the cows drop their calves in eary Spring on pasture. The calves are then raised and grown by nature's methods, which have never been improved upon. Their milk is taken fresh, as needed, clean, sanitary, and always at proper temperature direct from the udder. Their first supplemental feed is with Nature's greatest of all feeds—grass. Their natural physiologic growth and digestive organ requirements are thus constantly and properly met; as a consequence calf ailments under such conditions are almost unknown in the beef herd. Black Leg and Hemorrhagic Septicemia, two of the most common diseases of beef calves, especially range calves, are now prevented and have been practically eliminated by proper vaccination.

The method of feeding and handling after the first two or three months will depend largely on what is desired in the subsequent feeding and fattening program. If they are of good beef type and breeding it may be desirable to creep fatten the calves on pasture, while nursing their dams, with resultant maximum efficiency and economy of gain. Calves so fattened and finished are never allowed to lose their milk fat. They may be sold if near suitable markets when about eight months of age. Baby beef so produced is a special product and must have a market desiring such type carcasses. Baby beef of this age and quality lacks the flavor of older beef, but is preferred by some and on suitable markets brings premium prices.

Most beef calves are carried to greater maturity and heavier weights and are still classified as baby beef, up to 1,000 pounds, or in some cases slightly over this weight. They may also be fed lightly and then later finished as yearlings, or be carried over largely on roughage and full-fed subsequently as two year olds. This permits a variation in the beef feeding program suited to a wide variety of farm and market conditions.

Much study and experimenting has been given to considerations relative to the different age feeding propositions. Results show that with good quality beef calves, having an initial weight of about 400 pounds, daily average gains of 2 to 2.5 pounds per head may normally be expected during a feeding period of six months. This is based on an average daily feed consumption of corn or barley 10 lbs., protein supplement 1 lb., good hay 4 lbs., and corn silage 4 lbs. Their approximate average feed requirement to produce each 100 pounds gain will be, grain 450 to 475 pounds, pro-

tein supplement 50 lbs., hay 200 lbs., and silage 200 lbs.

Yearlings will require approximately one-fourth more grain, hay and silage than calves if finished to comparable gains and condition. Two year olds will need about 45 per cent more grain and 40 per cent more roughage than calves as a feed requirement for similiar gains.

Wild Garlic Control

WILD garlic is a serious weed pest. It reduces yields and is objectionable in crops and pastures because of its undesirable odor. Garlicky milk is rarely marketable and wheat infested with the ill smelling pest is graded down.

Garlic differs from most weeds in that it makes most of its growth during cool weather. Old plants mature in early summer and the new generation starts growth during fall or early winter. The plant reproduces from underground bulbs as well as from bulbs and seed developed at the top of the plant. These underground bulbs form normally in early spring. The dates of setting bulbs vary widely with the location, temperature and type of soil. In Indiana the period ranges from February 1 to May 1.

In order to effectively eradicate wild garlic it is necessary to prevent underground bulb setting. This can be done by keeping the top growth down during the period of normal setting. Fields infested with garlic should be plowed in late winter or early spring. A good job of plowing so as to turn under all top growth is essential. After plowing the area should be disked to keep down all green growth. The field should be planted to a spring crop such as oats, soybeans, tomatoes or corn. Often garlic bulbs lay in the soil for sometime before germinating making it necessary to follow the practice of winter plowing for two or possibly three years in order to produce a complete eradication.

Wild garlic often is spread thru impure seed wheat. Bulbs formed at the top of the plant can be removed by careful cleaning after they have been allowed to dry out thoroughly. It is difficult to separate the heavy green bulbs from wheat because they are similar to a wheat kernel in weight and size.

—*Cappers Farmer*

Permanent Pasture Treatments Compared

Condensed from Better Crops With Plant Food

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DURING the last 20 years there has been a gradual realization that permanent pastures provide feed to grazing livestock at a lower cost than any type of harvested crops. With the area of permanent pastures making up 20 to 40% of the farm land in the humid region, it is obvious that pastures constitute one of the greatest agricultural resources of the country. Generally speaking, this resource has been developed only to a small degree, although many experiments have been conducted and much has been written on the subject in recent years. It seems likely that the feed-supplying power of the permanent pasture lands may be doubled or tripled by efficient treatment and management, thereby reducing feed costs still further, as well as increasing the quality of the herbage and the seasonal uniformity in growth.

Many pasture improvement measures involve little or no cash outlay for materials and are thus within reach of all farms. Among these may be included the removal of unnecessary trees, elimination of all brush, bog plants and similar vegetation, mowing 2 to 3 times during the season to keep undesirable growth under control, and occasional distribution of animal droppings by harrowing. These practices alone have been shown to greatly increase the total herbage production. However, when they are combined with adequate soil improvement measures and effective control of grazing practices, the full value of the pasture is realized. Since pasture lands have, in general, been greatly neglected from the standpoint of maintaining soil fertility, it is not surprising to find that treatments with lime, manure, and fertilizer are of great value.

One of the current problems in pasture improvement is to determine the type of soil-improving materials to use. The ideal type of treatment will naturally depend on the type of grass sod present, the character of the soil, and its past history. Lime, wheth-

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er applied as ground limestone or in some other form, has usually produced good results on acid soils only when used in conjunction with other materials. Lime alone rarely improves the growth of pasture herbage, because lime is not the only limiting factor. On the other hand, the use of fertilizers without lime has often been disappointing, since both types of materials are needed to provide balanced nutrition of the grass. Except on limestone soils, in New Jersey the use of as little as one-half ton per acre of finely ground limestone has been uniformly desirable in conjunction with fertilizer or manure, even though the pH does not indicate strong acidity. Larger applications will, of course, be effective over a longer period, but one-half ton a year will distribute the cost and provide all the lime needed each year.

An application of farm manure once in 2 years has also been a profitable treatment, probably because of the nitrogen and potash which it contains. Manure reinforced with superphosphate provides a more adequate treatment than manure alone. Since manure is usually available in quantity on livestock farms, application of manure to pastures in late fall and early spring is an important part of pasture improvement in many cases.

Experiments and farm experience have repeatedly demonstrated the great value of nitrogenous fertilizers for pasture improvement. It has not been so clearly understood that nitrogen fertilizer applied alone is much less efficient than when properly balanced with other nutrient elements. An example of this response is provided by a 3-year test on a typical red soil pasture in New Jersey (Table I). The lime, phosphate, and potash were applied in alternate years, and the nitrate of soda annually in March. Although nitrogen alone increased yields 64%, the same amount of nitrogen supplemented with lime, phosphate, and potash increased yields 143%, and moreover, the condition of the sod at the end of 3 years was greatly improved.

Nitrogen may be supplied very effectively on many pastures by stimulation of clover with lime, phosphate, and potash. In this test, and many similar ones in New Jersey, such treatment greatly increased the abundance of clover in a single year. It is interesting to note that the LPK treatment produced a strong clover sod and an annual yield of 2,236 pounds of dried clippings, in comparison with LPK plus nitrate which produced 2,466 pounds. Where clover can be stimulated by mineral fertilizers, the yields may be nearly equal to those obtained under compara-

tively heavy nitrogen fertilization.

Incidentally, it should be noted that potash was a very essential element when used in conjunction with other materials applied. Potash added to the LNP treatment increased yields of dry clippings 716 pounds, and when added to LP, the increase was 890 pounds of clippings. Obviously, potash is a highly essential part of a complete treatment. Although these results are for only one pasture, they are fairly typical of those obtained on a total of 25 similar tests scattered throughout New Jersey on pastures located on Coastal Plain, Piedmont, Appalachian Valley and Upland, glaciated, and river bottom soils. The degree of response varied, but the same trends were noted throughout.

Two important points in a pasture improvement program are (1) the relative cost of producing feed with the various systems of improvement, and (2) the seasonal growth of such herbage. To obtain information on these points, an experiment was conducted on a typical permanent pasture sod at New Brunswick, New Jersey. A direct comparison was made between the lime-minerals-clover system and the lime-minerals-nitrogen system of treatment. The results of a 3-year test, given in Table 2, indicate clearly that the lime and minerals treatment which stimulated clover produced feed at a lower unit cost than any other treatment. The total yield per acre, however, was greater on the plots receiving nitrogen fertilizers. The protein content for the season was nearly 19% for both types of treatment. On the 25 similar tests conducted throughout the State, palatability was highest on plots rich in clover, the nitrogen-treated plots ranked second, and the untreated plots had low palatability.

Table I—Pasture Response on Penn Shale Loam, 3-Year Average, 1936-1938 Inclusive. Flemington, N. J.

Treatment	Condition of sod in 1938	Average percentage clover in 1938	Annual yield of dried clippings lb. per acre	Relative yields of herbage (%)
None	Fair	3	1,005	100
N only	Fair	Trace	1,647	164
Lime, N & P	Medium	Trace	1,750	174
Lime, NPK	Good	15	2,466	243
Lime, P	Medium	18	1,346	134
Lime, P & K	Very good	65	2,236	222

Rates of application: 1 ton limestone, 450 lb. 16% superphosphate, 150 lb. muriate of potash, all in alternate years. Nitrogen as 300 lb. nitrate of soda annually in March.

Clippings harvested every 2 weeks throughout the season.

For the period covered by these tests, about $35 worth of commercial dairy ration was needed to produce feed equal in nutritive value to a ton of dried pasture clippings with 18% protein. It is clear, therefore, that pasture improvement was exceedingly profitable in all cases, provided the forage produced was actually utilized by the grazing herd.

The factor of seasonal production of herbage is a most important one in pasture management. Permanent pastures in general produce an abundance of feed in May and early June, but yield a scanty supply during the heat of summer. Since the surplus growth of spring becomes quite unpalatable if held over to midsummer, the ideal treatment would be one which maintains rather uniform growth throughout the grazing season. Because of moisture shortage and unfavorable high temperatures in summer, this ideal cannot be attained with present-day vegetation. Other things being equal, treatments which produce a greater yield in mid-summer may have greater value.

The seasonal distribution of feed shown by Table 3 indicates that a nitrogen fertilizer treatment in conjunction with lime and minerals is of greatest value

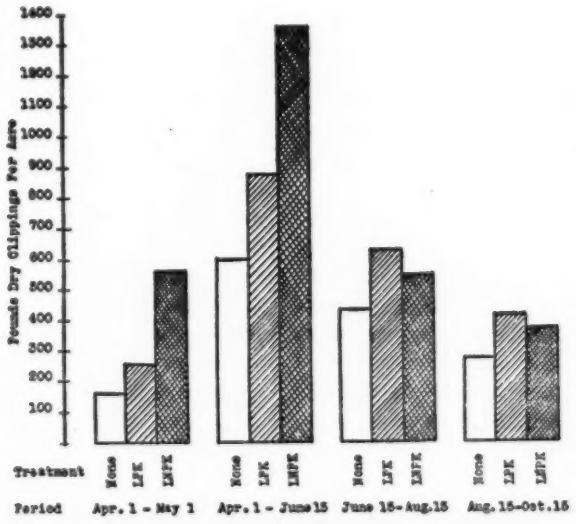

FIG. 1. EFFECT OF TREATMENT ON GROWTH OF HERBAGE IN DIFFERENT PERIODS OF THE GRAZING SEASON

for very early growth. The yields of herbage in April were more than three times as great under nitrogen treatments as with no fertilizer, and more than twice as great as with lime and minerals. This superiority of nitrogen treatments was maintained up to June 15. For the balance of the season, at those times when pastures are normally the shortest and feed is needed the most, the LPK treatment which stimulated clover was the most effective.

Table II—Comparison of Lime-Minerals Clover and the Lime-Minerals-Nitrogen Systems of Treating Permanent Pasture on Woodstown Loam Soil. 3-Year Test, New Brunswick, N. J.

Treatment	Average clover in vegetation (%)	Annual yields of dried clippings (lb.)	% Protein content	Total cost per ton of clippings
1. None	22	1,308	15.0	$13.76*
2. LPK	36	1,921	18.8	12.60
3. LNPK	14	2,281	18.7	16.15
4. LNPK (Plus N in June)	6	2,466	18.7	17.78

Treatments once in 3 years: 1 ton limestone, 600 lb. 16% superphosphate, 150 lb. muriate of potash.

Annual treatments with nitrogen: 300 lb. sulfate of ammonia in March. June application—200 lb. sulfate of ammonia.

Annual acre costs: land use $4.00, mowing $2.00, fencing charges $1.25, labor applying fertilizers on LNPK plots $1.75, labor applying LPK once in 3 years $0.65.

Lime and fertilizer costs: actual values.

*When corrected for lower palatability, but not for lower protein content, this value should be $16.85 per ton of clippings.

Table III—Seasonal Distribution fo Herbage Growth as Affected by Treatment. 3-Year Average, New Brunswick, N. J.

Soil Treatment	Before May 1	Before June 15	June 15 to Aug. 15	After Aug. 15	Total for season
	Yields of dried clippings lb. per acre				
None	164	600	435	273	1,308
LPK	252	881	626	414	1,921
LNPK	555	1,354	552	375	2,281
LNPK (Plus N in June)	619	1,366	730	370	2,466
	Relative yields of herbage (%)				
None	100	100	100	100	100
LPK	154	147	144	152	147
LNPK	338	226	127	137	174
LNPK (Plus N in June)	377	228	168	136	189

These results should not be interpreted to mean that nitrogenous fertilizers have no place in pasture management. On the contrary, unless clover or a similar legume can be made an important part of the pasture sod, there is no alternative to the liberal use of nitrogen fertilizers. Moreover, such fertilizers will provide feed on pastures 2 to 3 weeks earlier than would otherwise be possible, and thus reduce barn feeding accordingly. The surplus feed on fertilized pastures of all types may be cut in late May or early June and preserved as hay or as grass silage. In either case, this feed is available to feed livestock during the summer shortage of pasture.

The type of pasture treatment should be chosen to suit the need for feed. On farms with limited acreage for pasture, a greater net gain to the farm might be obtained from the more intensive system of treatment with its higher yields, provided all of the feed so produced could be used effectively. On farms with more adequate pasture acreage, the treatment with lime and minerals (without nitrogen), which brings in clover, would be the most profitable. Perhaps the best system on many farms would be the use of heavy nitrogen fertilization (balanced with lime, phosphate, and potash) on a portion of the pasture for early grazing, and the use of lime, phosphate, and potash to stimulate clover on the remainder. In any system, it is highly essential that the utilization of feed by grazing and harvest keep pace with herbage growth, if the full value of pasture is to be obtained.

Artificial Breeding

Condensed from The Jersey Bulletin

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THE effort to improve the average merit of dairy cattle through the united efforts of co-operating dairymen has been greatly stimulated by the application of the techniques of artificial insemination to American conditions. The necessity for effective co-operation among dairy farmers to solve the many difficult breeding problems facing them long has been recognized. Programs to aid in the solving of such problems have been carried out. Bull associations have been formed. Other means of community breeding have been suggested and in some cases adopted. However, the acceptance of such programs was not rapid and improvement in the quality and producing ability of the rank and file of dairy cattle in this country promised to proceed at only a slow rate. Not until wide-spread community use of artificial insemination was suggested, did many dairy farmers enthusiastically consider a program of improvement in their own herds.

This was due, in large measure, to the many opportunities which the practice of artificial insemination seemed to offer. Sires proven to produce daughters of satisfactory conformation and milk-producing ability could be bred to many more cows by artificial means than by natural service alone. Thus, the blood of superior individuals could be wisely disseminated. For the small herd the cost of service would be less than the cost of maintaining a good bull, and it was hoped that better bulls would be available than the individual dairyman could afford. Disease hazards could be decreased by proper veterinary supervision of herds co-operating in an artificial breeding project. No hazard would be involved in mating heifers to aged bulls. The physical risks of keeping a bull would be ended. The financial risk of loss of bulls through death, disease or sterility and the risk of the bull actually siring inferior progeny would be borne by all members of the co-operative.

During the past two and one-

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half years artificial breeding of dairy cattle has been on trial.

Problems have arisen, some of which have already been fairly well solved, others are still unsolved. Co-operative artificial breeding organizations are being formed in all of the dairy sections of this country, and research programs designed to answer many of the puzzling problems which have arisen are being carried out in many of the Agricultural Experiment Stations of the nation.

The question has often been asked as to why this country was so slow in accepting artificial insemination for breeding dairy cattle.

The answer is that we were not ready for it. To appreciate this fact we must realize that only recently has the attention of dairymen generally been focused on the necessity for herd improvement. The emphasis in the Dairy Extension programs of the states has been directed towards the proving of sires in a widespread way only during the last ten years.

The Proved Sire Program of the Federal Bureau of Dairy Industry in co-operation with the Extension Service of the several states has focused attention on the production of the daughters of the many bulls in use in Dairy Herd Improvement Associations of this country. This program has been under way on a wide scale five years. The periodic reports on the progress of this program show that too few of the bulls used are increasing or even maintaining production in these herds. Only when these facts became generally known were dairymen anxious to try a new, revolutionary method of breeding and then only if it gave promise of good results.

It must also be appreciated that, while artificial breeding of dairy cattle offers many advantages to dairymen if properly controlled and handled, these same advantages can become definite drawbacks if such is not the case. The question of what bulls to use deserves and should receive careful attention. No group of dairymen can afford to use an inferior bull in an artificial breeding co-operative. A bull of low transmitting ability used on a large number of cows in a large number of herds would do almost irreparable damage to a whole community. A superior sire could do much good.

Where can outstanding superior sires be obtained and how can a group of dairymen select a sire so as to be fairly certain that he will increase rather than decrease the average merit of their herds? As we all appreciate, there is no definite, all-inclusive answer to this question. Nevertheless, sires proved to transmit

milk and fat production at economical levels under environmental conditions similar to those obtaining on the farms where they are to be used, are a fairly safe bet. However, proved sires are scarce and have been scarcer in the past than they promise to be in the future, as a result of the recently adopted Federal, State and Breed Association programs. Adoption of artificial insemination was held up, in part at least, by the dearth of desirably proved sires.

Additional reasons for the slow acceptance in this country of this method of breeding already used in European countries for several years were of a technical nature. The evolution of the methods of collecting and handling of semen and insemination of the female was slow. In fact, the development of satisfactory methods for collecting semen under any and all conditions was the main drawback. The development of the artificial vagina now in common use was one of the important contributions in this field. Also, in Russia where artificial insemination was first practiced on a wide scale, it was possible to have on hand many females in heat where the semen was collected. Thus, hazards involved in handling and transportation of semen, necessary under American conditions, were not important. It remained for the Danes on the Island of Samso to develop on a small scale the techniques of transportation of semen to farms and there inseminating the female. It was in Denmark that Prof. E. J. Perry, of the New Jersey College of Agriculture, saw this method of breeding in use. Upon his return to America, he organized the first artificial breeding organization in this country.

The New Jersey group was organized in the spring of 1938. Apparently, dairymen of this country were in a position to accept the responsibilities of such a program, for since that time artificial breeding organizations have been formed in every section of the country and thousands of cattle have been bred by this means. A recent survey indicates that cooperative organizations are now in operation in at least 16 states and 5 more states are in the process of organizing or have just recently organized artificial breeding circuits. At present, New Jersey, New York and Wisconsin lead in the number of cattle being bred by this means.

At the present moment, it is estimated that somewhere in the neighborhood of 50,000 cows will be inseminated by artificial means in the United States during the coming breeding year. This number fades into insignificance beside the estimated 25 million dairy cattle in this country. However, this figure does

show that this method of breeding is being tried by American farmers on a gigantic experimental scale and that it will not be long before we have a pretty definite idea of whether the method is to become a standard community breeding technique.

The trends in artificial breeding of dairy cattle are indicated by recent developments. In the first groups organized a circuit was composed of about 1,000 cows centrally located about a convenient place for housing the required number of bulls. It was generally considered that about three bulls per 1,000 cows would be required. When a circuit was made up of cows of more than one breed more bulls would be necessary, which tended to increase the overhead costs for service. A qualified veterinarian was employed by the members of the co-operative, and it was his duty to collect semen, inseminate cows, keep records and collect payment for service.

In the main, the costs to the member dairymen were a $5.00 membership fee and a charge of $5.00 per cow inseminated. This charge entitled the member to as many as three services for each cow signed up, but if she did not become pregnant the co-operative was responsible for no more. This was done to prevent the enrollment of too many poor breeding cows in the program. In addition, a capitalization fee of about $1.00 per cow was often charged to defray the costs of erecting suitable quarters for the bulls and to pay for certain required equipment.

When many of the first circuits were started this income was perilously close to the edge of safety even if things ran smoothly. Ordinarily, little was left for an emergency. When a bull failed in service, or the circuit covered so much territory that travel expenses of the veterinarian ate up much of the income, the co-operative was faced with a difficult problem of making the income cover the costs.

Because of this circumstance, the trend has been towards larger units. In some cases, enough bulls may be housed in one bull barn to supply semen to breed several thousand cows. Several individual circuits, each employing their own veterinarian, may then operate from this centralized bull barn. Thus the overhead costs of maintaining several barns and the costs of duplication of equipment have been reduced, and financial security in some measure attained. This, of course, is possible only in those areas where there is a high concentration of cows. In areas where the cow population is less dense, the question of supplying service at economical cost yet remains a serious problem.

A method to reduce the cost of service has recently been adopted in New York. Several co-operatives which were in operation decided to pool their resources and to form a central bull holding co-operative. Each original organization became a member of the holding company. The bulls were then shipped to a central point, Syracuse, easily accessible to train, bus or airplane service, and there housed. The central bull barn is under the direction of a well trained man who is responsible for the feeding and handling of the bulls. Each day he collects semen from the bulls owned by the member circuits, dilutes it, and then ships it to the veterinarian employed by each member circuit, some of which are located more than 100 miles away. The semen is wrapped in insulating cloth and shipped in cheap, cardboard containers, used for packaging ice cream, in which is placed a predetermined number of rubber balloons containing ice. This method has proved successful over a few hours' transport and is economical.

New organizations desiring to become associated with the central organization pay a certain portion of the service fee and the capitalization fee to the bull holding co-operative and become a member circuit. The required number of new bulls are then purchased and are used to supply semen to the new circuit. This enables a new circuit to establish itself with a minimum risk of financial failure. This method has aided in reducing overhead and tended to spread risk. Recently, when one bull allocated to a circuit suddenly died, the other bulls owned by the central organization were used to supply semen and insemination continued uninterruptedly. Also, when a block of bulls allocated to one circuit are no longer useful because their daughters are ready for breeding, a trade can be made with another member circuit and each bull maintained in service as long as he is fertile without running into the danger of inbreeding.

This set-up has also enabled member circuits to receive semen from bulls of certain breeds of which they have too few cows to support bulls. Thus if several member circuits have enough cows of a certain breed signed up to support a block of bulls they can receive this service even though as individual circuits they could not afford it.

When artificial breeding circuits were first organized, the plan was to depend primarily upon desirably proved sires as a source of semen. However, proved sires are often aged sires and unable to stand hard, routine service. What is more, good proved sires are hard to find and in cer-

tain areas where the program is expanding the farmer co-operatives have been competing against one another in the purchase of bulls. Recently, it has been appreciated that a sound program can be perpetuated only if each circuit accepts the responsibility of sampling and testing young bulls. Thus the circuits can prove their own bulls at a minimum of risk to each dairyman. Young bulls of desirable pedigree should be obtained and bred to at least 50 cows in a number of herds and then should be retired from service in the circuit until their daughters have been tested. Most circuits now have in their plans such provisions for sampling young bulls.

While the organization trends are towards solving financial problems with the ultimate aim of reducing the cost of service, the technical problems which have been tackled also have this aim in mind. The object has been to increase the efficiency of artificial insemination and by so doing to reduce costs. When artificial insemination was first used in this country the methods of handling of semen were not well worked out, and recommendations of foreign workers conflicted.

It has been shown that for best results considerable care must be taken in the collection and handling of semen. Especially during the cold, blustery days of winter, care must be taken to prevent so-called "temperature-shock" of the spermatozoa during collection. Sudden chilling has a deleterious effect on the keeping quality of semen. For storage of semen for any period of time, it should be gradually cooled to a storage temperature of about 40° Fahrenheit. This temperature tends to maintain the sperm in a quiescent condition and to maintain fertility over a longer period of time than when stored at higher temperatures. This is due, in part, to decreased activity of the sperm, which conserves their energy, and also to the fact that detrimental bacteria, which are easily introduced into semen at collection and are only reduced to a minimum by very careful methods, cannot grow and multiply appreciably at this low temperature. Temperatures as low as 35° Fahrenheit have been used, but these lower temperatures appear to have no important advantage over the slightly higher temperature of 41°.

In this connection, it is interesting to note that several scientists have experimented in the quick-freezing of semen in the hope that fertility might be maintained after such treatment. If this could be done a great step forward in animal breeding practice would be accomplished for, after the initial freezing, semen

might be kept in this condition for years. However, though motility after freezing and subsequent warming has been observed in these experiments, successful impregnation has not occurred. This may be a brilliant achievement of the future.

To inseminate the maximum number of females from each service of a bull, it is necessary that the semen be diluted. When artificial breeding circuits were first organized in this country, a diluter, developed by a Russian scientist, was used which did not improve the keeping quality of the semen. In fact, semen stored alone would maintain its fertility over a longer period of time than when the semen was diluted with this fluid.

However, just a little over a year ago the finest single contribution of American scientists to the study of the preservation of bull spermatozoa was announced by workers at the University of Wisconsin. Paul H. Phillips and his associates at that institution had found that egg yolk mixed in equal parts with a chemical buffer, composed of a dilute solution of di-basic sodium phosphate and mono-basic potassium phosphate, and adjusted to a final pH between the range of 6.7 to 6.8, was remarkably effective in promoting the life of sperm. Pregnancies resulted from the use of semen mixed with the yolk-buffer diluter after 100 hours of storage. Later these same workers reported pregnancies from semen stored as long as 180 hours.

The Cornell Station has recently completed an experiment using this yolk-buffer diluter in which over 1,500 inseminations were made. The results show that when proper precautions are taken in handling the semen and diluter, semen may be diluted with this mixture and stored up to four days with results as satisfactory as with semen used on the day of collection. In this experiment only that semen was used for insemination which showed satisfactory motility after storage. An average of 1.44 services were required per conception in this experiment.

The discovery of this diluter by the Wisconsin workers has greatly aided the co-operative breeding organizations. It has made it unnecessary to collect semen so often and thus hastened to maintain sires in service longer than would otherwise be the case. In some cases it has made it unnecessary to purchase additional bulls. Also, by increasing the efficiency of insemination it has tended to reduce the cost of each service and thus aid the circuits in keeping within their budgets.

One very important problem which is demanding the attention of the scientists is that of developing a quick method of de-

termining the quality of semen. In fact, this is our most important need at present. Since the important discovery of Williams and Savage some time ago that bulls producing semen which contained more than about 20 per cent of abnormally formed spermatozoa were sterile, there has been a great deal of work in this field, all of which tends to bear out the general results. In addition, certain determinations, such as estimations of motility of sperm, relative pH of semen, and length of survival of sperm under standard conditions of storage, offer some indication of the quality of semen. However, these methods are slow and a more rapid, accurate method is needed.

Recently, an English physiologist reported that the determination of the rate at which sperm use oxygen is a reliable method of determining the relative quality of semen and hence the fertility of bulls. This method has been studied quite extensively in this country, but it is too complicated to be used by other than well-trained scientists.

From the standpoint of commercial breeding, the real test of the quality of semen produced by a bull is whether it successfully impregnates a high proportion of the females inseminated. Experience over the past two and one-half years shows that fertility is a matter of degree. Published results indicate that the number of services per conception in artificial breeding circuits usually vary from 1.5 to just over 2.0, but that some bulls may require less services than this minimum and some as high as 4.0 or more services per conception. It is obvious that some fertile bulls are actually more fertile than others. These facts have been known for a long time but not until artificial insemination was undertaken was it so thoroughly emphasized to dairymen.

No artificial insemination circuit can hope to operate with bulls of low fertility. Consequently, the fertility of dairy bulls has become a much discussed and studied problem. We have suddenly come to appreciate that we know all too little about feeding and management of bulls so as to maintain them in fertile breeding condition.

Nevertheless, experience in artificial breeding circuits will aid in solving some of the many problems which arise. Already, the importance of regulated exercise in maintaining a bull in full breeding power has been demonstrated. It has also been shown that the amount and kind of feed, especially the quality of the roughages fed, have an important bearing on the fertility of a sire.

Experiments conducted at the Ohio Experiment Station show

that when poor quality roughage is fed to developing bulls, the sperm producing organs fail to develop properly, and sterility results. This is due to a lack of sufficient vitamin A in the diet. Work at the Wisconsin Station indicates that a lack of Vitamin C in the blood of bulls is an important cause of sterility. As it was not possible to increase the vitamin C content of the blood by feeding, bulls were injected with a solution of purified vitamin C in amounts equal to 1.0 to 1.5 grams per 1,000 pounds live weight. This treatment was effective in returning to active fertility about 80 per cent of the bulls treated. Young bulls responded most satisfactorily to treatment. Other investigators have since tried this treatment and in general obtained the same results.

Recent Cornell studies tend to show that bulls fed high quality roughage, possessing a bright green color and high in vitamin A, seldom if ever suffer from a vitamin C deficiency. This and other evidence indicates that a vitamin A vitamin C interrelationship exists and that the bull feeder should feed only the best quality of hay to bulls in heavy service. Quality of the hay is all the more important when only limited quantities of hay are fed in order to prevent sluggishness due to a distended middle.

As we consider these recent scientific developments, most of which are not yet widely applied in the field, and consider the recent trends in the organization of artificial breeding units, it becomes increasingly apparent that the effort has been directed towards making artificial insemination an effective tool in dairy cattle breeding. If the recent boom has accomplished nothing else, it has focused attention on many problems which have long needed consideration. It has stimulated wide interest in herd improvement.

Legumes Build Soils

Condensed from Southern Agriculturist

L. R. Neel

LEGUMES are certain pod bearing plants that make use of atmospheric nitrogen. Included in this group are the clovers, alfalfa, lespedezas, beans, peas, vetches, crotalaria, kudzu, etc. Most of these plants have the ability to make use of nitrogen in the air to feed the plants. This is made possible by the presence of certain bacteria associated with the roots of the plants, forming nodules or little knots or balls. Unless the legume is inoculated artificially or naturally from the soil, neither the nodules nor the beneficial bacteria will be present and the legume will be just like the corn plant, depending upon the nitrogen supply found in the soil.

Legumes must be chosen to suit the soil and often they require some special treatment. Most of them do not thrive in acid soils so that the use of lime is necessary to make them grow successfully. They are also greedy users of mineral fertility so that if the phosphoric acid or potash of the soil is low, they can not do well. Therefore, fertilizing with a material furnishing either one or both of these elements is often necessary to secure satisfactory growth of the legume. For instance, sweet clover must have lime, whether in the soil naturally or applied it will need phosphate to make a good growth, and potash if the soil is low in this element. But with these requirements met it grows luxuriantly on subsoil, in washes and on banks, and greatly increases the nitrogen supply of the soil.

Legumes will make use of soil nitrogen alone unless they are inoculated. Moreover, even when inoculated they use some soil nitrogen and some atmospheric nitrogen. The proportion in which they use it will vary with the fertility of the land. On rich land they may use mainly soil nitrogen while on poor land that has lime and needed mineral fertilizer they will draw more from the air and less from the soil.

This crop, which stands there on our land with a charge against it of only one-third of its nitrogen against the soil and two-thirds a gift from the air where the supply of nitrogen is unlimited, looks mighty good to us. But, as usual, there is a catch to the transaction. This nitrogen is

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stored in the roots and in the top of the plant and much the larger part of the nitrogen is in the above-ground portion of the plant. In alfalfa and red clover the part above ground contains about two-thirds of the nitrogen, the part below ground, one-third. In the case of peas and soy beans about 85 per cent of the nitrogen is in the above-ground parts and the remainder in the roots. The stubble that is left helps increase the part that the land gets, but even then the harvested crop commonly leaves the field a debtor to the soil supply of nitrogen; that is, the load of hay (the leaves) got more nitrogen from the soil than it took from the air and left in the roots. The proof of this contention is that cowpeas grown ahead of wheat and removed for hay soon run the yields of wheat down to such a low point that farmers abandon the cowpea-wheat rotation except where they turn the peas under, giving the land all of the crop.

Land has been hurt by lespedeza in the same way, although not as rapidly as by cowpeas. This is probably due to the fact that less erosion takes place when lespedeza is used and because often more aftermath is left to be turned under. Of course, if lespedeza is cut for hay late, or is turned late for wheat, a poor yield of wheat will follow, due to the dry condition of the seedbed, even if the supply of fertility is fair.

In general, the legume is not a soil builder if taken off the land and nothing returned to make up for this. Being able to get a substantial part of its nitrogen from the air it can make a fine growth on land that will give a very ordinary crop of corn or similar crop but soil can not be built up with legumes unless the above principles are recognized and proper restoration is made.

Red clover failed in Tennessee and in a number of other states and Korean lespedeza came along about that time and it seemed to be a godsend. It would have been, too, if we had stopped to consider how it drew nitrogen from both air and soil and that the larger part of this was stored in the top so that each crop removed could store but little, if any, nitrogen and often left the field in debt to the soil. Furthermore, the lespedeza, like all legumes, uses greedily of mineral plant food so that continuous removal of hay crops without any restoration may leave the soil deficient in potash and phosphate. Already troubles with lespedeza have begun. Sometimes the crop itself is not growing well and in other cases crops that follow it are proving disappointing.

This necessary co-operation can be accomplished in several ways. Legume crops can be

grown just for green manure to be turned under for a sown or cultivated crop. Then the land gets all. If mineral fertilizer is used according to need, then soil building or the supplying of nitrogen for a crop to follow results. When the fertility of soil is low, such a green manure crop may increase wheat ten to fifteen bushels per acre and corn as much or more. The operation may pay well. Vetch, winter peas and, to a less extent, crimson clover are used in this way to increase fertility for cotton, tobacco and corn crops. The practice generally pays and the land may be left somewhat better even after the cultivated crop has been removed from the soil.

If the green manure crop is a palatable one it can furnish valuable pasture that will afford a second profit from its use without materially lowering its value as a soil-improving crop. Crimson clover and small grain are used extensively in this manner. Sweet clover will pay its way as a pasture crop so that the soil improvment received from it is net gain. To a less extent soy bean and cowpea crops are pastured before turning under to be followed with a winter or spring crop. If this does not seriously delay soil preparation for the crop that is to follow, the pasture may be a net gain.

If the alfalfa, red clover, lespedeza or cowpea hay that is hauled from the field is fed in well-bedded barns where the livestock are kept confined for long hours of the winter days, manure will be produced that will make it possible to build soil by growing legumes in one of the most practical ways. Each load of hay fed in the barn should produce one and one-half to two loads of manure for the fields, if the barn is bedded and stock are kept up at least three-fourths of the time. Of course, grass hays, straw, silage and concentrates also help make manure for the fields. The important thing is to see that all of the lands that produce crops get their share of the manure.

If the pasture land is limed and contains adequate mineral fertilizer and legumes are present in the mixture, the condition there is very favorable for soil building. Especially is this true if the grass and clover are not overgrazed. White and hop clover and, while there is room for it, lespedeza, belong in the pastures of most of the South. They enrich the feed and gather nitrogen from the air that is finally stored in the soil. In Kentucky some pasture land containing plenty of legumes was found to gain 700 pounds of nitrogen to the acre in eight years. In a commercial fertilizer this nitrogen would be worth $87.50 per acre.

Mechanized Land Clearing

Condensed from Farm Journal and Farmer's Wife

O. A. Fitzgerald

FOUR hundred people watched intently as the driver mounted the biggest tractor most of them ever had seen, threw it into gear, speeded up its 83 horsepower Diesel motor and hurled its 18 tons squarely into a patch of stumps and trees.

The monster crawler with a bulldozer attachment ripped up those stumps just as though they were so many stakes stuck in the ground. Trees with trunks eight and ten inches through were pushed over and torn out of the roots as though they were weeds in the garden. When all the trees, stumps and brush had been uprooted, the machine circled about and pushed the debris into a big pile to dry out before burning. In a few minutes this machine did what would have taken days by hand.

This picture I have tried to paint was a land-clearing demonstration in Latah county, Idaho, in July. Multiply this picture a few hundred times and you get an idea of the interest in mechanized land clearing throughout the Northwest. The county agent sent only one notice of the Latah county demonstration and 400 people came.

Greatest appeal of the tractor-bulldozer method is its low cost. In eight western Washington counties where thousands of acres are being cleared every year, costs of mechanized land clearing are varying from $17 to $73 an acre, with the average at about $37. In one county a bulldozer worked 1,908 hours and cleared 300 acres at a cost of $22 an acre.

Since these land-clearing monsters are too expensive for individual farmers to own, there is a trend toward co-operative purchasing. Owners of big tractors capable of doing this work find plenty of business. Some county commissioners are considering purchasing the equipment and making it available on a rental basis to farmers of the county.

Likewise in northern Wisconsin, land clearing with tractor and bulldozer has made rapid strides. The work started in Bayfield county, and from there has spread into other sections of the state, and also into Minnesotea and Michigan. There are now 90

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outfits at work in this tri-state area.

This is an area where the amount of cleared land per farm has been too small to provide sizeable farm income, but small enough to produce delinquent taxes. In some sections the clearing machines are privately owned, and in other sections it is a co-operative venture. Here's how the system works in Bayfield county:

The county agricultural committee owns two machines and rents their services to individual farmers. All expenses, including fuel, operator and upkeep are furnished by the committee. The charge ($5 the first hour and $4.50 for each succeeding hour's work) is designed to make the tractors pay for themselves in four years.

A machine will move into any township only after it has been guaranteed at least 100 acres of work. Usually this original 100 acres turns out to be at least 200 before the machine moves on. During the summer of 1939, with one machine working, 1,400 acres were cleared at a cost to farmers of $5,000. This clearing increased the assessed valuation of the land by $57,000. In the fall of 1939 a second machine was purchased. These machines worked in two shifts, and were kept busy all season.

Costs run from $5 per acre for land containing stumps only, up to $28 and $30 for that covered with second-growth saplings. Cost varies also according to whether or not the trash is pushed into windrows.

Says S. E. Squires, chairman of the county board, and owner of the farm where the machines were first tried out: "We have the county zoned into areas which are suitable for agriculture, recreation, or forestry. It is unlawful for persons to settle for the year round on land which is zoned in the forestry district. If someone already owns land in this district, the government will trade them land in an agricultural district for their land in the forest area."

In this way the county government helps to cut down the chance of failure, and keeps land unfit for farming from being cleared and broken. One half of Bayfield county is publicly owned.

Testing Citrus Maturity

Condensed from Texas Farming and Citriculture

WHEN the shipping of Lower Valley grapefruit and oranges into national markets became extensive, many growers developed a strong tendency to push their fruit for sale before it was ripe enough to leave anything but a bad taste in the mouths and minds of consumers. The latter, assuming that the fruit was all right and willing to pay a relatively high price because of its scarcity at the beginning of the season, were "stung" by green fruit in such an increasing number of instances that a prejudice was created against all Texas citrus. To correct this costly abuse, foresighted growers procured in 1927 the passage of a Texas law prohibiting the shipment of Texas grapefruit and oranges until the fruit showed by scientific tests a certain specified juice content and degree of sweetness.

This law gave rise to an inspection and testing service which in 1927 employed one chief inspector and twelve assistants. The increase in shipments is indicated by the fact that the inspecting and testing in 1939, under the direction of Chief Inspector L. E. Pratt, called for the services of about one hundred and fifty assistant inspectors. The test period starts shortly before the shipping season opens, usually at the first of October, and continues into December. During this period sixteen testing stations are maintained, one in each shipping community from Mission southeast to Brownsville, a distance of about sixty-five miles. To take care of the comparatively small volume of grapefruit and oranges produced in Texas outside the Lower Valley, two stations are operated in the Winter Garden area, one at Laredo, one at Carrizo Springs, and one at Falfurrias.

Before any stations are opened, a small force of inspectors makes tests in various parts of the Valley to ascertain the degree of maturity of the crop in general for information as to when the stations should be opened and the full force put to work. This is an economy measure. In addition to these survey tests, preliminary tests of groves are made at the request of growers who desire data as to the degree of maturity of their fruit.

When an official test is made, an inspector goes to a grove and in the presence of the owner or his agent picks about fifteen

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fruits of the variety to be tested. These are taken from different parts of the grove in an endeavor to make them as representative as possible of the grove's entire production of the specified variety. A collective sample of this kind is picked from each ten acres.

The sample is taken to the district laboratory and its juice is scientifically analyzed to determine whether or not it meets the maturity requirements. It may be stated incidentally that after a close study by chemists as to what constitutes maturity, the requirements were made more exacting at the beginning of the 1936 season. When the sample passes the maturity standards, the owner of the grove receives a certificate of maturity which specifies the variety of fruit, its size, the location of the groves and the number of trees. No railroad, trucker or other carrier is permitted to transport uncertified fruit during the period of operation of the testing service.

In the 1939 period there were 56,255 laboratory tests of all citrus varieties. Of these, 41,560 were grapefruit. A total of 19,790 passed the tests the first time. Fruit in some of the groves was tested five or six times before it showed adequate maturity. The average of sugar content in all grapefruit samples tested during the period was 10.57 percent. It may be noted in passing that this indicates exceptional sweetness, the average in most other citrus sections being considerably lower. The requirement for the passing of Texas grapefruit is 9 percent sugar, or soluble solids, as the sugar is described technically. The ratio between this minimum and citric acid must be at least 7.2 parts sugar to 1 part acid.

Cream Beef

Condensed from Capper's Farmer

J. F. Clayton

EACH of four milk cows on Bob Ellison's farm in Hill county, Texas, nurtures four calves and accounts for 800 lbs. of beef during a lactation. That beef has paid better, he asserted, than the cream those cows would have produced. Three of the cows are Jerseys and the fourth a common red. They are capable of producing 300 pounds of fat annually on pasture and ordinary farm feeds, without forcing.

"I used to sell cream," he explained, "until the price went so low the cows wouldn't pay their keep. Then I worked out this scheme of converting cream into beef and letting calves relieve me of the milking."

But the beef he makes is not this hybrid stuff that comes from the dairy sections. It's straight Hereford, as highly finished as any that ever went out of a Corn Belt feed lot. The calves are baby White Faces, shipped to the Fort Worth market, presumably as vealers, but usually too light for that trade. Mr. Ellison pays $3 to $8 a head for them and they average about 100 pounds. Two are turned with each of the cows on pasture and suckle 4 or 5 months.

"When they weigh 300 pounds, I wean them on to Dallis grass and go get another bunch," he said. "Each cow will suckle two sets of calves in a lactation, a total of four and each calf will gain 200 pounds while he's suckling. That gives me 800 pounds of beef from each milk cow, and for what grass she and the calves eat.

"That beef has averaged about eight cents a pound during the time I have been following this plan, or $64 a lactation. Cream prices have ranged from 11 to 28 cents, and averaged about 20. The fat those cows are capable of producing at that average would return only $60 a lactation. So, by converting it and the milk into beef I'm not only making more money but saving myself a lot of work. Even at the high price for fat, I'd have only $20 a year for milking a cow, which isn't an attractive wage, and she would need more feed than I'm giving under this system."

After a few weeks on grass, the calves are given a 90-day dry

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lot feed on ground corn, cottonseed meal, and hay. They finish as 800-pound baby beeves. The early lactation bunch go to market in spring and the later ones are carried through winter to be put on feed June 1, for September sale. Thus, on a 4-cow pasture capacity, he is turning out 16 feeder calves a year.

The milk cows are bred to a Jersey bull and the heifers are developed to breeding age. The fullblood Jerseys usually are sold to 4-H Club members.

Mr. Ellison's farm consists of 123 acres, 40 of which produce cotton, 20 are in pasture, and the rest is planted to corn, oats, and sowed pasture. He plants a small area to wheat every fall, at a 4-bushel rate, for pasture. After drilling, he broadcasts 4 pounds an acre of black medic. Oats also is sowed for fall, winter, and spring pasture and he prefers it to wheat but it may freeze out. Ten acres of the two normally supply grazing for the four cows, 8 to 10 yearlings, 15 ewes, and a buck.

The black medic germinates during winter and grows up in spring to supply grazing when wheat goes out at the boot stage. It carries the stock to the last of May, when it matures and seeds. Remaining growth is turned under and the medic will volunteer next season.

Dallis grass affords a pasture season from early spring until freezing weather, about 9 months. During the winter period when it is dormant, he uses wheat and oats. To supplement it in summer, Mr. Ellison grows 8 acres of rowed Sudan.

His lambs are dropped in January and February. They subsist and finish on the grain pasture and dam's milk, at 80 pounds, in April and May, just after the Easter run. "I get them out on the wheat pasture just as soon as they are able to follow the ewes," he explained. "They get no grain, nor do I feed the ewes unless the weather is bad and then only if they come up to the barn."

Wheat at the heavy seeding provides abundant grazing as the stocking previously mentioned indicates. He ran 15 ewes and 17 lambs on 3 acres. His experience in feeding no grain is confirmed by experiments at Purdue University in which no grain ration experimenters were able to compound would make as good gains as abundant, lush, fresh growing pasture.

Self-fed Lambs Do Well

Condensed from The Farmer

SELF-FEEDING of corn and other grain to lambs is taking much of the guesswork out of the lamb feeding business besides making it possible for inexperienced feeders to come through their first year of feeding with little lamb loss and with a reasonable profit.

Until recently lamb feeders believed that if lambs were self-fed they would overeat and all sorts of digestive troubles would result. Then P. S. Jordan and W. H. Peters, animal husbandmen of the College of Agriculture, University of Minnesota, conducted some experiments at the Morris, Minn., Station to learn whether this was a notion or a fact. The experiments have proved it to be a notion . . . that *self-fed lambs do not overeat,* that there is no more digestive trouble among them than among hand-fed lambs, and, of course, that self-feeding saves much on the labor bill.

Foundation of the success in self-feeding is in diluting the corn with oats or alfalfa. All the experiments have proved that corn should represent from 60% to 70% of the ration. Last year the lot which returned a $3.35 profit per hundred pounds above feed cost, the highest profit shown, was fed a mixture of 60% coarse ground corn and 40% chopped alfalfa.

The feed is put in hoppers that feed down into troughs just like those used to self-feed hogs, turkeys or chickens. At Morris these hoppers were attached to the old feed bunks. Space at feeders, an important matter in hand feeding, becomes even more important in self-feeding. Allowance of a six-inch space per lamb at the feeders proves to be sufficient. If, for example, there were 1,000 lambs on feed there should be 500 lineal feet of space at the feed troughs.

Of course, lambs must be worked up gradually to the rich corn ration. The practice followed at Morris and by farmers who are self-feeding is to give the lambs the usual scant rations the first few days. Alden Schendel, a Wilkin County, Minn., feeder, who self-fed about 400 lambs last year started by giving them only wild hay and water the first two days. Then he began grain feeding by sprinkling a little oats in the feed troughs, gradually increasing the quantity. Another gradual change was made from oats to corn and from wild hay

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to alfalfa hay. The alfalfa hay was chopped and mixed with corn in a roughage mill. Incidentally a roughage mill is a necessary piece of equipment in this method of feeding, but the saving in labor, makes a more than satisfactory profit on the mill investment.

At the outset of the chopped alfalfa-corn ration the ration consisted of 90% alfalfa and 10% corn. Gradually the amount of alfalfa was cut down and the corn built up until the lambs were getting 65% corn and 35% alfalfa when they were on full feed.

At Morris all lots of lambs are hand fed their grain for 20 days before changing to self-feeding. Of seven lots fed during the last feeding season, six were given varying proportions of alfalfa and corn, and one lot had its corn diluted with oats, getting 25% oats and 75% corn. Daily rate of gain was greatest for those lambs getting the chopped alfalfa-corn mixture, but when profit was computed it was discovered that with oats at 28 cents a bushel and alfalfa at $8 a ton, the feed cost per hundred pounds of gain was a little in favor of the oats, However, there was no significant difference in the profit per lamb.

Questions come up repeatedly as to how to substitute some other kind of roughage for self-feeding when alfalfa isn't available. Mr. Jordan suggests that when wild hay or some other non-legume roughage is fed in place of alfalfa the lambs be given their protein and lime requirements as supplements. To build up the protein percentage he advises adding oilmeal at the rate of 10% of the ration, and to provide the lime required he suggests mixing finely ground limestone with salt in 50-50 proportions.

Close observers of this method of feeding lambs during the past two years have been the Reginer Brothers, Morris and John, of Lyon County, Minn. Until this season they have been hand-feeding from 800 to 1,300 head a year, but this year they are self-feeding. Interesting to other feeders has been these brothers' success with soybean hay in feeding lambs. Lambs have done well on it, and although it is a little harder to start them on bean hay than on sweet clover they seem to like it better than sweet clover after they have acquired a taste for it. All the roughage on the Reginer farm is chopped in a roughage mill.

Soil Conservation

Hugh Hammond Bennett
Chief, U. S. Soil Conservation Service

THE earliest settlers arriving on the North American continent found a land richly endowed by nature and virtually unexploited by man. Except in an inconsequential way, the aborigines had done little to cultivate this land or change its virgin character. Before the gaze of the transplanted Europeans lay a vast wilderness teaming with apparently inexhaustible stores of game, fish, fur, timber, grass, and soil. Across the broad expanses of the country, from semi-tropical to boreal climates, from humid to arid regions, spread an infinite variety of soil types, topographic and climatic conditions, and vegetative types and patterns. Almost everywhere the fertile land supported some kind of vegetation—trees or grasses, shrubs or chaparral. In all but a few scattered barren areas, dense stands of perennial plants sheltered the ground from the elements and enriched it with their decaying material. Soil nourished vegetation, and vegetation protected soil, in a compact of mutual advantage and growth.

Rains fell on the land, and snows melted with the changing seasons; but water tended to move slowly over the ground surface, checked and kept clear by the tangled canopy of vegetative growth. The deep, humus-charged, granular topsoil, perforated even into the sub-soil by decaying plant roots and burrowing earthworms, insects, and animals, soaked up the raindrops, which filtered down to nourish the growth of vegetation or to replenish underground reservoirs and springs. Rivers ran clear, except in flood, when abrasive rushing waters tore soil from the banks, sometimes muddying even the Missouri and the Mississippi. Generally speaking, however, the natural circulation of waters was a uniform and orderly process. Flood heights and silt-laden streams were spasmodic exceptions in a land of prevailing harmony and balance. Topsoil was removed from the land surface no faster than it was built up from beneath by the slow, complex processes of nature.

The March of Occupation

Into this virgin land the eager colonists entered with energy and enthusiasm. They began a transformation of the earth's surface that is probably without parallel in the history of the world. The

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occupation of the continent was accomplished not through steady infiltration of population into undeveloped regions but rather through a remarkably rapid advance over a wide front by farmers, stockmen, prospectors, miners, trappers, loggers, explorers, and adventurers. Along the line of advance, there was little thought of conservation or of depleting resources. With a country of immense potential wealth beckoning for development, it is small wonder that the emphasis lay, unconsciously, on speedy exploitation.

For a time, the advance was checked by an extensive belt of forest land bordering the Atlantic and eastern Gulf. Cutting, girdling, and burning acres of timber required hard work and patience. For more than a hundred years, settlement was largely confined to a relatively narrow strip lying along the Eastern seaboard. Eventually, however, with the pressure of new population from Europe, the westward trek began. Moving slowly at first, the pioneers set to work on the virgin forests with axe and fire. Little by little, the land was cleared for farmsteads; vast quantities of timber were burned at the "logrollings" of the settlers; trails and roadways were opened into the heart of the continent.

By about 1830, most of the better land east of the Mississippi was occupied. Then, across the grasslands lying west of the river, the migration moved at a much swifter pace. Over vast areas the prairie sod of the tall-grass country was broken with amazing speed. Before long the short-grass country of the Great Plains was also invaded, first by buffalo hunters, then by ranchmen, and finally by farmers. By 1890, most of the better lands lying within the borders of the United States had been settled. After little more than 200 years from the beginning of the westward movement, the last frontier was dissolved in the Pacific Ocean.

History records the daring of the early pioneers, who blazed the path for a new nation, and the heroic suffering of the settlers who followed. In many respects it is a thrilling story of adventure, hardihood, and courage. The march across the continent was accomplished in the face of great odds and sometimes at tragic costs in human misery. It was followed by a rapid and energetic development in agriculture, industry, commerce, transportation, and communications, which finally produced one of the greatest nations on the face of the earth.

Depletion of Natural Resources

Both the march of land occupation and ensuing national development were accompanied, however, by a prodigious wastage of

the resources with which nature originally stocked the land. The white inhabitants of this country, in their "conquest of the wilderness" and their "subjugation of the West," piled up a record of heedless destruction that nearly staggers the imagination. Slopes once clothed with forests now lie bare and stark. Formerly rich lands are riddled with gullies. Level plains country that once supported lush stands of native "short" grasses is overgrown with weeds or covered with shifting sands left in the wake of dust storms.

What caused this tragic transformation? What happened to the bountiful land that inspired early explorers to enthusiastic comment and rhapsodic description? The answer lies largely in a false philosophy of plenty, a myth of inexhaustibility, which prevailed generally for many years and persists, in some quarters, even at the present time.

Yet in the time of our forefathers this was a normal, perhaps an inevitable, reaction to environmental conditions. Nearly everywhere the early settlers faced rich farm and grazing lands, which stretched away as far as the eye could see. There was every reason to conclude that the agricultural domain was limitless and inexhaustible. Free land extended to the far horizons. Occupation was encouraged by the Federal Government, by the territories and states, by railroads and land companies. Go West, and take your choice of free land or cheap land, was the advice to young and old. It was a dramatic era—an era of empire building. For a hundred years the settlers came by ox cart, covered wagon, and railway. For a hundred years this hurried settlement of the West absorbed the rapidly increasing population of the nation. It was only natural that those who took over the West, like those who occupied the East, should look upon the grasses of the virgin prairies, plains, and tablelands and upon the trees of the valleys as nothing more than obstacles in the way of human progress.

The fact remains, however, that much of the land was abused, mined, and ravaged. In the turmoil of national growth, abundant resources were reduced to a state of impoverishment or near-extinction. Buffaloes were slaughtered by the thousands, merely for their hides. Trappers took their harvest of pelts without restriction or restraint. Protective forests were cut from sloping hillsides and entire watersheds; immense areas of grassland were broken or bared by the onrushing settlers with their plows and their livestock. Minerals were extracted, and their wealth dissipated in a surge of exploitation.

The story of the passenger pigeon is characteristic. The last of these birds died in a Cincinnati zoo in September, 1914. Ornithologists say that once this species was one of the most abundant game birds ever known in any country. Their flights frequently darkened the skies; the branches of trees are said to have broken off by the very weight of their numbers settling to roost. Yet within a few generations, the legions of this species have been effaced from the earth. Should man dwell upon this planet for millions of years, he would never behold another passenger pigeon.

In like manner, other valuable resources have been exhausted and continue to be exhausted. What the final result will be in terms of the national economy no one can predict with accuracy. One fact, however, is eminently clear. The potential wealth and living standard of this nation, or of any nation, depend ultimately on its store of natural resources. If, through carelessness and neglect, these resources are waste beyond a certain point, the whole structure of national achievement must be impaired.

Soil Erosion

Out of the long list of nature's gifts to man, none is perhaps so utterly essential to human life as soil. And topsoil is the most vital part of soil (made up of topsoil plus the layers beneath). Lying at an average depth of about 7 or 8 inches over the face of the land, this upper layer of the soil is the principal feeding zone of the plants, which provide food for human or livestock consumption, fiber for clothing, and timber for shelter. Soil constitutes the physical basis of our agricultural enterprise; it is a *sine qua non* in the production of practically all food (except fish), of all fiber (without exception), and of wood (without exception). Under many conditions, however, it is the most unstable of all major natural resources.

Water or wind, in moving across the ground surface, exerts an abrasive force which picks up soil particles and carries them away in suspension. In a natural, undisturbed environment, the dense cover of vegetation retards this surface transposition of soil to a pace so slow, generally, that new soil is formed from the parent materials beneath as rapidly as the finished product (topsoil) is carried away from above. Under such conditions, the removal of topsoil is known as *normal erosion*, sometimes referred to as *geological erosion* or the *geologic form of erosion*. It is a normal process proceeding with the tediousness of centuries. It abrades at one place and builds (aggrades) at another. In slowly sculpturing the high lands of the world, it contributes material for

the development of alluvial plains, valley fills, and aeolian deposits.

Where the land surface is bared of protective vegetation—as it must be under cultivation—the soil is exposed directly to the abrasive action of the elements. Transposition processes of an extremely rapid order are set in motion. Stripped of the protective cover that normally anchors soil to the landscape, this indispensable material frequently is moved a thousand times faster than under natural conditions. This accelerated phenomenon of soil removal is known as *soil erosion*. Unless steps are taken to check its progress, it becomes the most potent single factor in the deterioration of productive land.

This volume is primarily concerned with processes, effects, and controls involved with soil erosion—the accelerated cutting away of land resulting from man's occupation and use. Fundamentals having to do with this abnormal process and its rate of progress, as well as with methods for its control or prevention, cannot be understood, evaluated, or adequately planned for, however, without an understanding of basic processes and rates pertaining to the geologic form of soil removal. The final answers to all the questions involved cannot be given now; nevertheless, much valuable information has been acquired through the instrumentalities of research, surveys, and practical work on the land.

Wastage of Soil in the United States

National habits of waste in this country have nowhere been exhibited more flagrantly than in the use of agricultural land. From erosion surveys, soil surveys, and other measurements of soil losses, it is estimated that erosion in the United States already has ruined, or seriously impoverished approximately 282 million acres. From an additional 775 million acres, erosion has stripped away varying proportions of the fertile topsoil. Considering only cropland, it is estimated that erosion has ruined about 50 million acres for further practical cultivation. Another area of cropland approximating 50 million acres is bordering on the same condition. Nearly 100 million acres more, still largely in cultivation, has been severely damaged by the loss of from one-half to all the topsoil. On at least another 100 million acres of cropland, erosion is getting actively under way.

Examining the details, it must be admitted that there was in this country a large aggregate area of inferior land to begin with, much of which was so obviously poor that it has never, to this day, been touched by the plow. Vast areas in the West were too rough, too steep, too

stony, or too arid for any use other than limited grazing or forestry. In the East there were large tracts too steep, too stony, too wet, or too sandy for ploughing.

Nevertheless, many fundamental principles of sound land use were grossly violated—tens of thousands of acres of excessively steep land were ploughed. Within 10 years, 20 years, 50 years, more or less, the soil has been washed away, and a condition of permanent, or near-permanent, ruin is the result. Even where the land itself was not too steep for a limited and conservative agriculture, farmers waded in with plough and axe, stripped nature's protective cover from the ground, and indiscriminately, without regard for the future, laid bare the rich soil to the erosive forces of wind and water. This was not done maliciously but simply without thought of the consequences.

Soil An Indispensable Resource

Lack of foresight and restraint, starting in the early Colonial period and continuing through the present day, has created in this country a land problem of tremendous implications. What makes the situation so grave is the irreplaceable nature of soil. Once this valuable asset leaves a field, it is as irretrievably lost as if consumed by fire, as far as that particular field is concerned. It cannot be hauled back economically even though temporarily stranded only a short distance down the slope. A thousand tons would be required to cover an acre to a depth of 7 inches.

REVIEW OF THE BOOK "SOIL CONSERVATION"

By HUGH HAMMOND BENNETT

Beginning with a broad survey of the problem in the United States today, the book reviews the experience of ancient civilizations and traces the link between the decline of the land and the decline of the nations of the ancient world.

The physical aspects of soil loss are discussed in careful detail. Every facet of the problem is explored—the relation of erosion to soil type, to slope, to cover, to climate; the rates at which erosion proceeds on various kinds of land under various kinds of use; the areas affected; the effect on crop yields, agricultural stability, and human welfare; the results in terms of floods, silted reservoirs, depleted wildlife, ruined roads, and the variety of other ills attendant on the waste of soil and water.

***Soil Conservation* explores the wide ramification of the land problem into many fields: physics, chemistry, biology, economics and sociology, climate, ecology, geology, engineering, etc. The point is stressed that a permanent agriculture can be achieved only by coordinating the knowledge of many sciences toward a common objective.**

Detailed attention is given to the varoius methods of land treatment which have proved effective in combating soil erosion. There are discussions of cropping practices: rotations, strip cropping, cover crops, protectve utilization of crop stubble; tillage practices: contouring, terracing, subsoiling, water diversion, and other mechanical methods of land treatment. Also fully dealt with are range and pasture management practices: adjustment of grazing to carrying capacity, developing of stock water facilities, improvement of forage by reseeding, fertilizing, and water spreading, and other methods for stabilizing and improving the range. Chapters are devoted to farm forestry and to the use of native plants hitherto overlooked in our cultural and pastoral practices. (Published by McGraw-Hill Book Co.—$6.00.)

Low Cost Hen House Roofs

Condensed from The Nebraska Farmer

F. E. Mussehl
Nebraska College of Agriculture

EXPERIMENTAL work at Agricultural College during the past three years has indicated that built-up roofs made with 15-pound felt paper, asphalt emulsion, and sand will give excellent service under Nebraska conditions. The following recommendations are based on three years' observations: First, roof boards should be laid as tightly as possible. The roof slope for best results should not exceed 15 percent or one-sixth pitch. Roof boards are then covered with 15-pound tarred felt paper, which is stripped with pieces of tin about one inch wide every 18 inches. It is best to run the felt and the metal up and down the roof instead of crosswise. Ordinary ungalvanized metal or waste tin scraps are satisfactory for this purpose, since the tin will be completely covered by the asphalt emulsion and sand layers which are applied later.

1. The first coat of asphalt emulsion should be diluted with an equal amount of water to give it greater penetrability. The asphalt emulsion can be spread very readily with an ordinary roofing brush. The first coat should be permitted to cure for from three to five days, depending upon weather conditions, before applying the next coat.

2. The second coat of asphalt emulsion should be applied straight without dilution, and sand should be thrown into the wet material immediately. After the entire roof has been covered, it may be brushed with a roofing brush to get a more uniform distribution of the sand. This second coat should be permitted to harden for a week or ten days before applying the third coat.

3. The third coat should be applied in a manner similar to that described for the second.

Observations made on a 20x40 poultry house located near Lincoln indicate that about five gallons of asphalt emulsion were needed for this size roof for the first coat, 10 gallons for the second coat, and 10 gallons for the third coat. About 1,500 pounds of sand was required for the second and third treatments.

Asphalt emulsion and sand applied as suggested for the second and third coats can also be used for the repair of older roofs.

Reprinted by permission from The Nebraska Farmer, October 5, 1940

Proper Care Ensures Long-Life Harness

Condensed from Western Farm Life

FARMERS can get additional years of service from their harness by giving them proper care. Nebraska extension service has given a number of recommendations, based on practical farm experience, which should add life to harness and save money for farmers.

Nothing in the care of harness or of horses themselves is more important than to wipe sweat and dirt off the collars with a wet cloth after work each day.

Although harness would undoubtedly remain in better condition if hung in a separate room away from the horses, few farmers find this practical. The next best thing is to hang the harness as high as can be reached conveniently, so the horses cannot pull it down and drag it under foot. Harness hooks should be fairly wide and rounded so as not to cut the leather. Collars should be buckled and hung bottom side up.

Ideally, harness should be oiled once a month. If at all possible, it should be well oiled once every three months, to prolong the life of the leather. The harness should be taken apart and the pieces put in a tub of lukewarm water for half an hour, then spread on a smooth board and scrubbed until thoroughly clean with a stiff brush and luke-warm water in which castile soap has been dissolved.

The straps should then be hung in a warm room for two or three hours, until all surface water is dried out. But while they are still pliable and feel moist, they should be spread flat on a board and oil or dubbing worked into the fiber with a brush. Dubbing is made by mixing tallow and neat's foot oil half and half. A little more tallow is needed in summer than in winter.

Tallow should be melted in a kettle at a low temperature, not to exceed 110 or 115 degrees Fahrenheit, and oil added after the tallow has cooled to approximately 100 degrees.

—*Western Farm Life*

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Feeding Timothy Hay Efficiently

Condensed from Guernsey Breeders' Journal

S. R. Winters

THE efficiency of timothy hay for milk production in dairy cattle can be raised to the efficiency level of alfalfa hay. By the addition of inorganic minerals, steamed bone meal and yeast to the supplementary ration fed with timothy hay, dairy cows can be made to produce four per cent milk as efficiently as when they are fed alfalfa hay as roughage.

At the Blacksburg, Virginia, Experiment Station, the Virginia Polytechnic Institute has been conducting group feeding experiments with alfalfa and timothy hay. The work covers a period of thirteen years, during which period various scientifically controlled rations have been tested for efficiency in milk production.

The results obtained should be of practical significance to dairy farmers. Even though the superiority of alfalfa hay for milk production has long been recognized, timothy hay, because of varying local conditions, constitutes a large part of the roughage rations of dairy cows.

One of the chief differences in the dietary value of the two hays is in their protein content. An analysis of two 100-pound lots showed that alfalfa hay contained 10.60 pounds of digestible proteins, while timothy had only three pounds.

In the first years of the Blacksburg experiments, the protein content of the timothy and alfalfa hay rations was balanced by additions to the supplemental grain rations fed with the timothy hay. With Number 1, green cured, leafy alfalfa hay, the following grain mixture was used: Fifty parts white corn meal, forty parts wheat bran, ten parts old process linseed meal and one part salt; with timothy hay harvested in the late bloom to early seed stage the grain mixture contained forty parts white corn meal, thirty parts gluten feed, thirty parts old process linseed meal, and one part salt. The increased amount of linseed meal and the addition of gluten feed in the ration fed with the timothy hay balanced the protein content of the two rations.

Even with this balance in protein, timothy hay was fourteen per cent lower in milk and butter fat producing value than the alfalfa hay. Averages for the first

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three months of lactation for the two groups show that while the cows fed alfalfa hay required 0.273 kilograms of total digestible nutrients to produce one kilogram of four per cent milk, the cows fed timothy required 0.314 kilograms. A corresponding difference was evident in the production of butter fat; to produce one kilogram the alfalfa hay group required 7.50 kilograms of nutrients, the timothy hay group 8.75.

Since it is believed that proteins derived from different plant sources vary widely in efficiency for milk production, the rations were adjusted to eliminate this factor. During the second part of the experiment corn gluten replaced part of the corn meal in the timothy hay supplement; corn meal was fed with the alfalfa hay. The complete grain mixture used with the alfalfa hay was as follows: Fifty-five parts white corn, forty parts wheat bran and five parts old process linseed meal. The timothy hay supplement contained twenty-four parts white corn, thirty-one parts corn gluten meal; otherwise, it was the same as the mixture used with alfalfa. Each ration, then, contained equal quantities of ingredients from the same plant sources.

A comparison of the averages for the first three months of lactation on this feeding program shows little if any change in the efficiency of the timothy hay ration. During the later months of lactation, there was some improvement in its efficiency.

However, when dicalcium phosphate and calcium carbonate were added to the diet of the cows being fed timothy hay, better results were obtained, especially during the early months of lactation. The alfalfa hay group required 0.325 kilograms of total digestible nutrients to produce one kilogram of four per cent milk; the timothy hay group required 0.310. The quantity of milk produced by this group exceeded the production of the alfalfa hay group. The averages were 1,023 kilograms for the alfalfa hay cows, 1,322 for the timothy group.

Individual variations in a given cow from year to year and the uncontrollable differences in quality of hays must be taken into account in examining these figures. Subsequent results indicate that the apparent increase in efficiency of timothy hay made by the addition of these minerals is not invariable.

In 1935, when the experiments had been in progress for seven years, ten grams daily of yeast were added to the diet of both groups of cows. The minerals were retained in the ration of the timothy hay group. In the first part of the lactation period the

requirement of total digestible nutrients for one kilogram of four per cent milk was reduced to 0.295 for this group, as compared to 0.265 for the cows being fed alfalfa hay. To produce equal amounts of butter fat, the timothy hay group required 7.79 kilograms; the others required 6.91. The averages for the last portion of the lactation period were not maintained at as high a level of efficiency for the timothy hay group.

In the final phase of the experiment, the yeast in the rations of all cows was increased to 100 grams daily. Steamed bone meal was substituted for the dicalcium phosphate and calcium carbonate in the supplementary feed used with timothy hay. It was with this feeding program that the best results were obtained. During the early months of lactation the averages of efficiency for the two groups were nearly identical. The efficiency of the timothy hay group declined somewhat in the later months of lactation, but was still maintained at a level higher than was reached with the other rations fed to this group. The unit requirements of total digestible nutrients to produce equal quantities of four per cent milk for the first three months of lactation are 0.262 for the alfalfa hay group and 0.263 for cows fed timothy. The corresponding averages for the production of butter fat are 7.53 for alfalfa and 7.10 for timothy.

Although the results of the last few months of this experiment have not been fully tabulated, it is indicated that the continued use of yeast and steamed bone meal in the supplemental feed of cows getting timothy hay as roughage brings the level of efficiency to that of the alfalfa hay ration. There is evidence that in many cases it even surpasses alfalfa hay in economy of milk production.

A comparison of the relationship between digestible nutrients available for milk production (the amount remaining when maintenance requirements have been deducted) and the amounts of milk produced, further illustrates the improvement in the timothy hay ration. When the rations were supplemented with steamed bone meal and 100 grams of yeast, the timothy hay group consumed 91.8 per cent of the amount taken by the alfalfa hay group. During this period the timothy hay group produced 90.7 per cent as much milk as the alfalfa hay group. Before the addition of the minerals, the two groups had consumed the same amounts of total digestible nutrients, but the timothy hay group had given only eighty-four per cent as much milk as the alfalfa hay group. On the average, in the years when minerals and

yeast were fed, milk production for the timothy hay group was in proportion to the digestible nutrients consumed within one per cent.

Throughout the experiments, the quantities of timothy and alfalfa hay fed were the same for both groups. Even with the supplemental rations described, when maximum digestibility of the nutrients in the timothy hay ration was obtained, the cows in this group did not give as much milk as those fed alfalfa hay. The differences inherent in the composition of the two hays account for this. It is assumed that an increase in the quantity fed would increase the milk yield without loss of efficiency if the supplemental feed is continued.

New Turkey Ration

TURKEYS grow fast and economically on a new ration developed by J. G. Halpin, G. E. Annin, and C. E. Holmes, at the University of Wisconsin.

Their experiments have borne out the experience of other scientists and poultrymen that turkeys will not grow well on ordinary chick mash. Turkeys need a ration richer in protein, and because protein feeds are the most expensive part of a ration, it is especially important to use a combination that produces good results at reasonable cost. The best combination found was: 5 lbs. meat scraps, 5 lbs. dried milk, 5 lbs. soybean oil meal, and 5 lbs. sardine fish meal in each 100 lbs. of mash.

Besides the 20 lbs. of protein supplement, the mash formula calls for 80 lbs of the following mixture: ground yellow corn, 35 lbs.; ground oats, 10; wheat middlings, 15; wheat bran, 15; alfalfa leaf meal, 5; granite grit, 1.5; limestone grit, 1.5; iodized salt, 0.5; cod-liver oil, 0.5; and manganese sulphate, 0.025.

Corn and wheat are used as scratch feed along with this mash.—Niemen Hoveland.

—*Successful Farming*

A New Horse for America

IN the comparatively short span of our history we have been responsible for the creation of several new breeds of horses. The American Saddle Horse, Standard Bred, Tennessee Walking Horse, and Morgan, are among the contributions we have made. This has not been the result of accident or fate, but each breed represents the ideal of a few men, their patience, determination and hard work. Someone has realized that a need existed, has visualized the type best suited to the need, and by selective breeding has standardized it.

An effort is now being made to bring even another breed into existance. Four years ago, Mr. and Mrs. Norman J. Mortimer, of New Hope, Pa., took the first steps toward the breeding of an American Hunter. The need is not alone for a horse that can carry a man safely in the hunting field, which after all is a matter of the pursuit of pleasure, but also for a horse that would meet the needs of the Army for Officers' mounts of which we have all too few.

I shall try to give a brief outline of how the Mortimers are going about this difficult business. In 1937 a Suffolk stallion was selected to breed on Thoroughbred mares. Two Suffolk mares were purchased for breeding to a Thoroughbred stallion. The choice of animals was extremely important, as on the judgment shown in this first cross may depend the ultimate success of the whole effort. The Thoroughbred was an obvious choice for one-half of the cross, the Suffolk less so. The decision to use the Suffolk was made because it was desired to use two breeds of as nearly equal antiquity as it was possible to find. The Suffolk goes back nearly four hundred years and is noted for breeding true to type. Cherry Hill Mack, the Suffolk stallion that was chosen, stands 16.3, weighs about 1700 lbs. and jumps four feet with ease and pleasure. He is a slightly leggy Suffolk with great refinement about the head, sound legs, and a beautifully balanced body. His disposition is beyond reproach, and he is described as having a great deal of personality. The Thoroughbred mares that are being used were chosen for good height, withers, neck, and above all sound legs and feet. It has been found necessary to get mares with as much quality as possible.

The oldest results of the cross are yearlings, of which there are three, two from Thoroughbred mares, and one from a Suffolk mare. Two of these were sent to the recent Breeders' Show at the Maryland State Fair grounds, where they won second and third in their class. They were topped only by a colt of predominantly Thoroughbred blood. Col. Hardy, of the U. S. Remount Service, in giving his reasons for so placing them, mentioned particularly their suitability for the hunting field, and their fine underpinning. One of this year's sucklings, out of a Thoroughbred mare by Mack, took the blue in her class.

In other words the idea is so far working out in a satisfactory manner, but now appears the really hard part of the whole business. It is planned to select one of the half bred colts to be used to breed to the half bred mares. All the theories of heredity rise up to haunt one at this point. The great need is for a prepotent horse with the power to transmit his own characteristics. First of all he must himself be all that is desired of his off-spring, but the matter of finding out whether or not he can transmit his qualities is one of trial and error. Consider the time to be spent during which mares are bred and colts are born and the time which must pass before a thing has been proven. The colt from one mare proves nothing, so as many as possible must be bred, and if the results are bad, one starts all over again. So far Mr. Mortimer does not think that he has the horse to use in this way. The first three colts are good colts but not quite the ideal in mind. This year only fillies were born, a matter over which one unfortunately has no control. So it will remain for some other year to produce the real founder of the breed to come. None of the potential breeding stock will be sold, and so far only one filly is slated to remain as a mother. There can be no compromise, no stock used that in any way falls short of the "horse in mind." The great essential is for the breeder to know his ideal and to keep it constantly before him with no blurring of its outlines, regardless of the difficulties encountered.

There are other ways in which the Mortimers can carry out their plans, other systems of breeding, various methods of crossing. The idea and the picture of the horse is there, and some day there will be an American Hunter.

Accidents Are Costly

Condensed from The Michigan Farmer

G. Stewart Brown

NO set of persons has a greater need of being on guard against accidents than the farmer and his family. Doctors are generally far away, ambulances and hospitals few, and, in case of injury, help may be long in coming. For these reasons, as well as for economic considerations, inhabitants of rural areas can perhaps least afford to meet with accidents.

In a sense it might be said that the farmer and his family actually run a double risk. Inasmuch as the home is generally an integral part of the farm, all members of the family are exposed not only to home accidents, which last year claimed approximately 32,000 lives, but they are also subject to the many hazards that go with agriculture. Lest anyone think these latter are slight, we need but consider the fact that last year there were more accident fatalities in agriculture than in any other industry, the total being approximately 4,300. This represents 25 per cent of all industrial fatalities.

For a number of years the American Red Cross has been actively seeking to increase safety on America's farms. It has established a Home and Farm Accident Prevention division, in cooperation with agricultural organizations, clubs, schools, parent-teacher associations and other groups, is endeavoring to bring home to America's population the need and value of being safety-minded. Colorful posters, movies, the printed word, questionnaires, lectures, individual accident-hazard surveys and group studies of home and farm conditions go to make up the program, which is conducted on a nation-wide scale.

Many Can Be Avoided

Many persons may not realize it but accidents generally occur as a result of pre-existing hazards or circumstances which, with a little effort, a proper amount of caution and the use of common sense, can be overcome or avoided. It is not fair to say that a machine or animal is the cause of accidental injury or death, when actually the cause lies in the exercise of poor judgment, or in a lack of knowledge, experience or skill by the operator or handler. The machine or animal is the agent of mishap, but not the real cause.

A farmer is gored by a bull and an accident is marked up. But

Reprinted by permission from The Michigan Farmer

what if the animal is known to be ferocious and the victim has not taken proper precautions to guard against attack?

When entering the barn he brushes against a projecting nail, breaks the skin on his arm and subsequently blood poisoning develops. But a few taps of a hammer would have eliminated all possibility of the wound.

While working near moving machinery a loose sleeve or pants leg is caught. But everyone familiar with machinery knows that an elemental principle of safety is to avoid loose or flapping clothing.

In the farm home, an effort is made to hurry the fire by using kerosene, and sometimes even gasoline. But everyone knows this is extremely dangerous and that, for the sake of the few minutes that may be saved, thousands of persons each year die a terrible and lingering death, while other thousands suffer serious and extremely painful burns. And children, having watched their parents, imitate them, frequently with dire consequences.

A gun is kept where everyone may reach it. Someone is accidently shot. But to keep it in a spot safe from young hands would be a simple matter.

A loose board causes someone to trip and pitch headlong down a flight of stairs. But, a hammer and nail would have prevented the probable injury and possible death.

Each of the above instances is classed as an accident. But every one is avoidable. Proper precautions in handling the animal, eliminating the projecting nail, wearing proper clothing when working with machinery, waiting a few moments for the fire to catch, keeping the gun, loaded or unloaded, out of reach of small children, and never treating firearms otherwise than as dangerous weapons, nailing down the loose stair tread, would prevent every one of these accidents. Each operation would take but a few moments and virtually no effort. And if these and other equally simple percautionary measures were undertaken in every home and on every farm in the United States, thousands of persons would be saved from untimely death, tens of thousands would be spared long and painful convalescence, and millions of dollars would be saved annually.

In addition to fatalities, home accidents last year resulted in 4,700,000 injuries and an estimated economic loss of $600,000,000, according to figures recently made public. Agriculture accounted for close to 600,000 injuries, of which approximately 125,000 were serious, and a probable economic loss, as represented by medical expenses, loss of wages,

and other items, of approximately $75,000,000.

Adoption of even the most elemental safety rules will pay immediate and extensive dividends in life, limb, and good, hard cash. Those that follow demand no great expenditure of effort or time. Analysis will show that each is based on sound, common sense. And each will be found to be good practice from the standpoint of making the farm pay greater returns.

Restrict the use of certain machines to adults trained in their operation.

Provide adequate guards for all machinery.

Locate workman so that he can quickly stop an engine used to operate any machine around which men must work closely.

Keep machinery and tools well oiled and in good condition.

Handle animals gently and carefully; teach children to do likewise.

Keep away from lone trees during electrical storms.

Do as much work during daylight hours as possible. Unless properly lighted, hazardous locations, such as haymows and silos, must be avoided after dusk.

To increase safety in the home, make a survey of the house. Are the floors and stairways kept clear of unnecessary obstructions, in good repair, well lighted, and not slippery?

Are porches and balconies protected with secure railings, with sound foundations, even floors and good screening?

If your home is supplied with electricity, is the wiring well insulated, are switches in order and in safe locations, and appliances shockproof?

Are tools, guns and sharp instruments kept in safe places out of reach of youngsters, and are they in good repair and always used with due care?

Do you keep a can of kerosene handy for use when starting the kitchen fire? Last year more than 5,000 persons died from burns and explosions occuring at home, many of them resulting from this practice.

Has your chimney been cleaned recently, are pipes safely located and connected and is the fireplace properly screened?

Do you keep matches in a noninflammable container, such as a tin can, and are they out of reach of small children?

Do you keep the children away from the kitchen stove and from open fireplaces?

Tremulous Air Cells

Condensed from Everybodys Poultry Magazine

Charles W. Knox

TREMULOUS air cells are defects in eggs whereby the inner and outer membranes separate at the line where the air cell ends. This defect is an important topic of discussion wherever market men get together. In one of their annual meetings the opinion that these weak cells were the fault of the producer either in his feeding or breeding of his chickens was offered. Furthermore, it was demonstrated that when an egg was jarred with the large end held downward, a tremulous air cell was produced which, of course, did not alter the interior quality of that egg.

Such opinions led to an experiment to determine some of the causes of tremulous air cells in eggs. It was realized at the start that a hen did not lay an egg with a tremulous air cell, therefore, the causes of this condition must be the care that the egg receives after it is laid.

Preliminary to this experiment it had been noted by the investigators at the U. S. Bureau of Animal Industry's Experimental Farm, Beltsville, Maryland, that hatching eggs received from the various sections of the county came in different kinds of containers and were packed differently.

All of these eggs were candled before being placed in the incubator and it was found that some packages contained a greater percentage of eggs with tremulous air cells than others. It was also noted that this was true irrespective of the distance that they were shipped. As a matter of fact, eggs received from the Pacific Coast had a smaller percentage of tremulous air cells than some eggs carefully packed and shipped a distance of only 250 miles. In the latter instance, all of the eggs showed tremulous air cells. These tremulous air cells appeared to hatch more poorly than the eggs with normal air cells.

Drawing on the experience in hatching these eggs and the opinions expressed by the market men, one case of eggs was shipped from Beltsville, Maryland, to Ames, Iowa, and return, and two cases to Chicago, Illinois, and return. The total distances shipped were approximately 1800 and 2400 miles, respectively.

Each case was made up of

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two lots of eggs which might be considered as loose packs and three lots as rigid packs. In one of the loose packs the ordinary filler and cup flats were used, and in the other, the same material was used, except the eggs were placed in every other space in the fillers. Of the three rigidly packed lots, two were in the ordinary fillers and cup flats, one with sawdust, filling the spaces around the eggs, and in the other, the eggs were wrapped with newspaper before they were placed in the fillers. The third rigid type pack was made up of the prong type fillers and flats. This type is used to some extent commercially and its construction is such as to hold the eggs rigidly.

The eggs were candled before they were shipped. All cracked eggs and those with other than normal air cells were eliminated. After shipment the eggs were candled again and classified in respect to the extent that the air cell deviated from the normal. Eight grades were made as follows; free moving air cells, very badly tremulous air cells moving but not entirely free, badly tremulous, tremulous plus, slightly tremulous, slight movement at the edge of the air cell, almost normal and normal.

Results of Packing Tests

Table 1 shows the results of the shipment of eggs. These data show quickly the relative value of each pack and indicate that fewer eggs are found with tremulous air cells in lots packed rigidly than in loose packs. It is also evident from these data that at least one major cause of tremulous air cells is the present type of container now used and that tremulous air cells can be eliminated to a large extent by the use of rigid packs.

The data in Table 2 give the results of shipping eggs in different packs a distance of approximately 1800 and 2400 miles. It is readily ascertained from the table that there is a significant difference in the condition of the air cells due to the distance the eggs were shipped. There were fewer eggs with tremulous air cells in the eggs shipped 1800

Table 1—Condition of Air Cells in Per Cent for Each Pack

Condition of Air Cell	RIGID PACK			LOOSE PACK	
	Newspaper Wrapped	Sawdust Packed	Prong Type	Filler and Cup Flat	Eggs Every Other Space
Normal	72.2	63.8	64.7	25.5	11.3
Tremulous	25.0	31.9	24.1	42.5	19.8
Badly Tremulous	2.8	4.3	11.2	32.1	68.9

Table 2—Condition of Air Cells in Per Cent for 1800 and 2400-Mile Trips

Condition of Air Cells	1800 Miles	2400 Miles
Normal	58.6%	41.0%
Tremulous	26.2%	30.4%
Badly Tremulous	15.2%	28.6%

miles than in those shipped 2400 miles. This indicated that the distance shipped and the additional handling necessary is another cause of tremulous air cells. In this case, however, the difference was not as great as the type of pack.

Pack Eggs Large End Up

In further experiments, it was found that jarring eggs with the large end down produced tremulous air cells more quickly than when the small end was down. Hence, eggs should be shipped for market or for hatching purposes with the large end up. In another part of the experiment, it was found that eggs with the air cells entirely free from the outer shell membrane, tremulous air cells, do not hatch as well as eggs with normal air cells. Seventy-seven per cent of the fertile eggs with normal air cells hatched and 56 per cent of the fertile eggs with tremulous air cells hatched.

From these experiments it may be concluded that eggs to be shipped for market or hatching purposes, regardless of the distance shipped, should be packed in rigidly and with the large end of the egg up. Avoid all types of packs in which the eggs are packed loosely or where the packing material is "springy" such as is the case with excelsior, straw or any such material.

Potato Digger Adjustment in Relation to Tuber Bruising

Condensed from American Potato Journal

E. V. Hardenburg and C. N. Turner

Cornell University, Ithaca, N. Y.

MECHANICAL injury is known to be one of the most serious and common defects found on potatoes sold in our markets. It was recently reported that nearly 40 per cent of all damage found on 515 retail store samples in the Cleveland and Rochester markets during the 1936-1937 marketing season was caused by bruising. A considerable portion of this bruising was caused by the digger. Hastings reported that a survey behind fifty diggers in 1930 showed an average of 38 per cent of the tubers more or less bruised by the digger. Werner in a similar survey made the same year on 47 farms found an average of about 20 per cent of digger-injured tubers. The significance of these results prompted a series of potato digger field demonstrations designed to show the grower how and to what extent bruising can be reduced by proper adjustment and operation of his digger. This is a report of the results obtained during the years 1936, 1937, and 1939 with 61 diggers on 32 different farms in 10 New York counties. The work was done jointly by the Departments of Vegetable Crops and Agricultural Engineering of the New York State College of Agriculture. The demonstrations served three purposes: (1) to emphasize the seriousness of digger bruising, (2) to illustrate how bruising can be largely eliminated by proper adjustment and operation of the machine, and (3) that these results can be obtained without cost to the grower.

Seven factors were found to be of considerable influence in relation to the incidence of bruising. Each of these factors is discussed in this report and the summarized results given in table 1. All percentages given in the table are based on a count of 100 tubers examined for each operation.

The amount of soil carried on the digger chain as determined by the depth of setting the point was found to influence the percentage of bruised tubers in each

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of 5 paired comparisons. With the point set shallow as already adjusted by the grower, 10.8 per cent of the tubers were bruised. By lowering the adjustment lever one or two notches to set the point deeper, the average per cent of bruising was reduced to 4.2 per cent, a difference of 6.6 per cent with odds of significance of 16 to 1. This is in accordance with results previously reported by Hardenburg for 72 New York farms in 1932. On those farms, bruising averaged 8.3 per cent less where 75 per cent or more of the apron was covered with soil than where 25 per cent or less was covered.

Most diggers, when purchased have been equipped with agitator sprockets under the elevator chain. Growers too often fail to replace these with rollers when the soil is dry and very little goes over the apron. The most appropriate place for agitation when needed is under the front elevator. Furthermore, it would seem desirable if more diggers were equipped with a lever to allow the operator to vary the amount of agitation in accordance with the variation in soil conditions in different parts of the same field. In the four-paired comparisons made in this study under dry soil conditions, replacement of the agitator sprockets with rollers reduced the average per cent of bruised tubers from 4.5 to 0.75, a difference of 3.75 per cent. Although there was a reduction in bruising in every instance, the difference was sometimes small with the result that the odds of significance are only 15 to 1.

It is fairly obvious in operating the digger that as the speed of the chain increases, less soil will be carried, the tubers will be thrown against the chain-rods and more bruising will result. It was shown in an earlier report that with an extension-elevator type of digger, bruising increased from 4.25 per cent when the chain was operated at low speed (7.2 R.P.M.) to 16.0 per cent at high speed (19.2 R.P.M.). In the field demonstrations where power take-off equipment was available, it was possible to compare low, intermediate, and high speed of apron as related to the incidence of bruising. Bruising increased directly with apron speed and averaged about 2, 8 and 15 per cent respectively, as shown in table 1. The differences in bruising counts between low and intermediate speed and between intermediate and high speed were nearly the same, averaging about 6 per cent. The difference between high and low speed in 7 direct comparisons averaged 13.6 per cent bruising, the odds of significance being relatively high.

A loose elevator chain on the continuous apron type of digger is subject to whipping at the rear

end. This frequently is the cause of unnecessary tuber injury. In these field tests with 10 diggers, it was possible to remove 3 to 5 chain rods and thereby eliminate the whip by tightening the chain. In eight of these ten comparisons, tightening the chain resulted in less bruising, the average difference being 4.2 per cent and fairly significant.

Most of the elevator diggers now in use are desiged for a separate or rear attachment apron. When such diggers are readjusted to provide a continuous apron, it is impossible without a change of drive sprockets to operate satisfactorily. Without an outside rear drive-chain, all of the draft is on the one main drive sprocket which results in undue wear of the sprocket teeth and of the chain and usually too much chain whip at the rear of the digger. By use of the outside rear drive-chain, this whip is eliminated and less bruising results. Bruising was reduced by an average of 3.0 per cent when this adjustment was made on three continuous apron diggers as shown in the table.

One of the oldest types of digger still widely used and still sold is the one with a rear attachment consisting of shaker-bars. Considerable bruising occurs when tubers drop from the front elevator onto these iron rods. More than one-half of this bruising can be eliminated by rubber padding at very little cost. This was demonstrated by padding nine diggers of this type with an 18-inch length of old auto tire over the horizontal bar and with a 12-inch length of one-half inch garden hose on each of the four vine-diverting tines. Bruising was reduced in every instance, the average reduction being 5.33 per cent and highly significant, as shown in Table 1.

Following the advent of the shaker-bar type of digger, came the extension-apron and still later the continuous apron type. Hardenburg found in a field survey of 251 New York farms in 1931 and 1932 that the continuous apron type bruised fewer tubers than either of the other types in common use. The continuous apron feature eliminates the rear drop of tubers and their consequent injury by the contact with iron rods. In the field demonstrations reported here, it was often convenient to compare two and sometimes all three types on the same farm and under identical digging conditions as indicated in the tabulated summary. In 8 of 9 comparisons of the continuous apron digger with the extension elevator type, the former resulted in less tuber-bruising by an average difference of 8.66 per cent, which is highly significant. In 4 of 5 comparisons between the extension apron and the shaker-bar type, bruising was least with

the shaker-bar machine. Here the difference was only 2.6 per cent and is not significant. Finally, in 12 of 13 paired comparisons of the continuous apron type with the shaker-bar digger, results were distinctly in favor of the former. The average percentages of bruised tubers were 1.92 and 10.46 per cent respectively, the difference of 8.54 per cent being highly significant with odds of 1428 to 1.

Table I—Potato Digger Adjustment in Relation to Tuber Bruising
(Based on 61 diggers—32 farms in 10 New York Counties 1936-1939)

Factor Related to Bruising	No. of Farms	No. of Paired Comparisons	No. of Tubers Bruised (Per cent)	Ave. Difference (Per cent)	Odds of Significance
Depth of Digger Point	4	5			
Shallow			10.8		
Deep			4.2	6.60	16:1
Agitation	4	4			
On			4.5		
Off			0.75	3.75	15:1
Speed of Apron					
Intermediate	9	10	7.6		
Low			2.3	5.30	81:1
High	7	7	14.0		
Intermediate			7.8	6.20	1428:1
High	7	7	15.0		
Low			1.4	13.60	434:1
Apron Tension	8	10			
Loose			7.4		
Tight			3.2	4.20	37:1
Rear Chain Drive	3	3			
Off			4.33		
On			1.33	3.00	16:1
Shaker-bar Padding	9	9			
Not Padded			9.55		
Padded			4.22	5.33	555:1
Type of Digger					
Extension Apron	9	9	13.0		
Continuous Apron			4.33	8.66	69:1
Extension Apron	4	5	11.20		
Shaker-bar			8.60	2.60	7:1
Shaker-bar	10	13	10.46		
Continuous Apron			1.92	8.54	1428:1

Hard or Mellow Backs?

Condensed from Sheep Breeder

J. F. Walker

RECENTLY a buyer for a large packing concern said in talking of some steers entered in a show, "some of them were too hard and lacked in mellowness. When beef is properly finished it has a firm yet mellow feel and gives under the hand. The skin reflects this in being soft and slightly rolling under pressure."

Within a few days after this incident occurred a livestock judge was in our barn for a stud ram. He said: "I do not want a hide that pushes forward under your hand. Yon cannot get a hard topped wether carrying such a hide and wethers must be hard to win."

This diversity of opinion as to what one should look for in a steer and a wether aroused some curiosity, so a large meat market was contacted and asked: "What makes good meat?" This particular market produces considerable of its meat on its own farms so it was thought it should be in a position to know. The reply was: "First, an animal capable of filling well in the high priced cuts area. Second, a rapid rate of gain with as little exercise as possible. Exercise hardens both the lean and the fat and makes tougher meat. Lamb is the same," he continued. "Lean and fat should be interspersed in the flesh and the well finished animal has a firm but not hard feel when handled."

Another angle appeared when a prominent showman was asked: "What is the proper finish on a show sheep?" "Make them hard as nails," he answered. "Get them fat then road the life out of them to get them hard. Put two inches of hard fat over their backs and three if you can, Tallow is what judges like. Hard tallow."

We sauntered past the carcass exhibit at the International and a gentleman intimately interested in the consumer angle of the meat business called our attention to some of the prize winners. "Look at the waste on that lamb," said he. "Two inches of hard fibrous fat. Nobody eats it, and all it is good for is high dressing percentage. Carcasses should be judged by their value over the block from a consumer's standpoint and not from an artificial dressing percentage basis."

It is quite evident that two schools of thought are here encountered.

The livestock judge and the

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showman want them hard and solid.

The butcher, the retailer and the consumer want a tender lean and a fat not too hard.

The cattle judge, judging for beef wants a mellow feel to the hide and firm but not hard fleshing.

The sheep judge wants a back like a rock and a hide stretched tight over it.

Are the cattle judges right and the judges of sheep wrong or vice versa, or should there be one standard for cattle and another for sheep?

Is the exhibitor right in wanting two inches of hard tallow over the back of a sheep, or is the consumer right in demanding as much lean meat as possible with sufficient fat to make it tender?

Should sheep be judged from the consumptive angle in mutton and wool, or from a standard solely from an exhibition viewpoint?

These are a few questions that breeders, exhibitors and judges might consider.

Judging by Performance

A revolutionary new showring judging method has been introduced to showmen this year. As yet applied only to swine, many experts believe that it will not be long before its principles are adopted universally by fairs and expositions for all classes of livestock.

First used this fall at the Mower County Fair, at Austin, Minnesota, the new method is based entirely on performance standards. For the barrow classes, prizes were awarded on the basis of litter weight at 56 days of the litter that the barrow represented, rate of gain for the barrow on exhibition, and carcass cut-out value of the barrow. Entries were grouped in three divisions on the basis of weight: a 160-180 pound group, a 180-200 pound group, and a 200-220 pound group.

Pete Holand, in charge of the Austin Sow Testing Association, which supplied the necessary records, is the originator of the new judging method. Under the usual system of judging swine, he says, an expert places the swine only on what he can see—without any consideration of the factors that determine profit and loss. Holand believes that the new judging method is applicable to all classes of livestock.

—*Successful Farming*

Incubator Fumigation

Condensed from New England Poultryman

H. A. Bittenbender

WITHIN the last decade incubator sanitation, has developed into an absolute necessity for most good hatcherymen. The fumigation of incubators and hatchery equipment must be adopted as an integral part of the program of disease control in the hatchery. In the beginning the control of pullorum disease was the big thing. Since then other problems have loomed up on the horizon—chick bronchitis and emphalitis.

Fumigation may be divided into two phases (1) the fumiga- of the incubator with or without eggs, but without chicks, and (2) fumigation of the chicks in the incubator. The procedure, in either event, is to be carried out after every hatch, either by the hanging of a formalin-soaked cloth (gauze) directly under the forced-draft fans, or by releasing the formalin by mixing it with permanganate of potash.

(1) Fumigation of the incubator with or without the Eggs.

Two essential points should always be kept in mind for success in fumigating with formaldehyde namely, that the temperature must be maintained at 96.5 to 100° Fahrenheit, and that the humidity must be kept at a high point, represented by a minimum wet bulb reading of 86 to 92°.

Of course, not every type of incubator lends itself to effective fumigation. The still-air, or sectional types of machines are difficult to fumigate for the reason that the germicidal gas tends to remain static, and will not spontaneously blend itself with the undisturbed atmosphere. However, in any machine where you have positive air circulation or agitation, formalin fumigation is satisfactory.

The proportion of formaldehyde gas for the fumigation of a given cubic capacity is of vital importance. In fumigating chicks it is imperative that the quantity of fumigant be carefully computed. Overdose is likely to cause trouble and underdose will not do the job. In our work we found that 35 to 40 cubic centimeters of formalin, when added to half as many grams of potassium permanganate, generated sufficient formaldehyde gas to fumigate effectively 100 cubic feet of air

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space, calculated by measuring the outside dimensions of the incubator and disregarding the air displacement of any trays or other equipment within. This ratio of the chemicals to the air space is sufficient to destroy *S. pullorum* infection, but does not satisfactorily control the mushy-chick (emphalitis) problem. To rid the machine of that infection, the amounts of fumigants should be multiplied 2 to 2½ times. Mushy-chick disease betrays its presence by the offensive odor of the dead chicks.

The question is sometimes raised, are there any times during the period of incubation when fumigation will injure the hatch? In the ordinary routine where the machine is set once or twice a week, we have not found, in our work, any evidence that the effects are injurious until the time the chick emerges from the shell, even with the use of 2 to 2½ times the quantities recommended.

As an example of the effectiveness of this procedure, I will mention one large hatchery that was having trouble with mushy chicks. The chicks were being found dead in the hatching trays and in chick boxes on shipment. We suggested that they fumigate with formalin and they said that they were already doing this. Then we insisted that they increase the amounts 2½ times when the eggs were transferred from the setting trays to the hatching trays, and we also insisted that they leave one untreated machine as a control. When they fumigated according to directions, not one chick was lost. In the control machine, however, as many as 9 chicks were found dead on some trays.

It should be borne in mind that thorough cleaning should precede fumigation. It is neither scientific nor practical to attempt to disinfect filth. Fumigation does not replace, but rather supplements, a thorough clean-up program as a disease-control measure.

Following fumigation of the eggs no injurious effect is observed up to the time of hatching. The doors of the machine are left closed. Normal ventilation through the ports is permitted. The operator should always arrange for the fumigation to be done at a time when he can vacate the room. Otherwise, the incubator doors are left closed for 7 minutes, after which the gas is neutralized by feeding through the air intake of the machine half as much ammonia (strong, not "household") as the amount of formalin used. This is necessary only from the standpoint of human tolerance.

(2) The Fumigation of Chicks.

This procedure must be undertaken only when the chicks are still moist. For each 100 cubic

feet of space to be disinfected, 35 to 40 cubic centimeters of formalin are mixed with half as much permanganate of potash, meanwhile maintaining high atmospheric humidity with a wet bulb reading of 90 to 92° Fahrenheit or even more, if possible. Low humidity tends to concentrate the action of the formaldehyde gas on the chicks with disastrous results. It is also of vital importance that the fumigants be so placed in the machine that the gas will be thoroughly mixed in the air channels before it reaches the baby chicks. If the humidity is high or around 92 to 93° (wet bulb), the wet chicks may be left in the closed machine for 8 to 10 hours, or until the next lot of chicks begin to dry. Under no circumstances should the same chicks be fumigated twice. All fumigated chicks should be removed before the second fumigation. Some hatcherymen delay fumigation until 40 or 50 percent of the chicks are hatched and depend on one fumigation to do the job, but this procedure is not so thorough as the one recommended.

In fumigating the chicks, if desired, the formaldehyde gas, after 5 to 7 minutes, may be neutralized with half the amount of strong ammonia as of formalin used.

If the soaked-gauze method of fumigation is employed, use only one-half the recommended amount of formalin, and hang the gauze pieces beneath the draft fans for proper circulation of the gas.

The majority of the incubator manufacturers have worked out satisfactory fumigation procedure appropriate to their makes and models of incubators. It is suggested that you obtain the recommendations of the maker of your machines for fumigation before undertaking this procedure.

A word about incubator and brooder sanitation for the control of bronchitis of chicks (gasping disease). Never attempt to operate the hatchery and chick batteries in the same building.

(1) Dispose of all live fowls on the premises. Any apparently recovered chick that you may retain may be a carrier of the infection and, as such, may supply the spark that will set off the disease in subsequent hatches.

(2) Clean room. Brush and flush down all dust and cobwebs from ceilings and walls, and from around windows and doors, etc. Use a strong jet of water for hosing down the entire interior of the hatchery and brooder room, etc. Remove all junk and miscellaneous stored material that may have accumulated. Include the office, sales room, and egg room in the cleaning and fumigation program. Fumigation will

not take the place of a rigorous clean-up.

(3) Fumigate everything with 2½ times the recommended amounts of formalin and permanganate of potash, first making sure that all windows are closed tightly, and that chimney flues and ventilators, as well as cracks in walls or around the doors and windows, are sealed with strips of paper or otherwise made gas tight.

The following are a few special suggestions on fumigating procedure:

Wet floors and walls to raise the humidity. Have the room as warm as possible up to 90° Fahrenheit. Place formalin in several large dishes evenly distributed throughout the building—not more than one pint in each container. Care must be taken to avoid an overflow of containers when the formalin and the permanganate of potash are mixed.

Straw Mulch

IN a rotation of corn, oats, wheat, and hay at the Ohio Agricultural Experiment Station, mulching the wheat with straw has shown no effect on the yields of corn and oats. One ton per acre applied late has not reduced the yield of wheat but *has* increased the yield of clover and alfalfa.

Altho two tons per acre applied early have increased the yield of alfalfa somewhat more, this application has materially reduced the yield of wheat. Top-dressing the wheat with nitrogen fertilizer in the spring helps correct this deficiency.— G. F., Ohio.

—*Successful Farming*

Buying Meat by Grade

Condensed from The Cattleman

SEVENTEEN years ago a finicky *maitre d'hotel* of a large American steamship line decided he ought to do something about the meat he was getting.

As the matter stood, it was too much of a hit-or-miss proposition. One day he would call up a dealer, put in his order for a couple hundred pounds of beef, and on delivery find that his purchase met his quality standards. A few days later, he would call up that same dealer, make a similar order, and discover that the quality of the meat was below the standard wanted.

Here was a buyer who bought carcasses, not cuts. But he found himself pretty much in the same boat as Mrs. Average Consumer at the meat counter. He wanted to be sure of the quality he got for his dollar every time he bought. For him, a daily tour of packers' coolers was out of the question. To depend on trial and error was expensive and sometimes ruinous to his reputation and service.

What was needed was some assurance of meat quality at the time he bought. He wanted to be able to buy grades of beef just as his company specified certain grades of steel when it laid down hulls for its ships. But grades for meat—to be of any use—had to be standardized, not haphazard designations on which no two packers agreed. For this standardization he turned to the U. S. Department of Agriculture which for a few years had been using tentative standards on classes and grades of beef as well as other types of meat in its work as a reporter of market news.

In a few weeks the buying agent was still buying beef over the telephone or by written orders. But now it was not "a hundred pounds of beef—and make it good!" Instead he could ask his local supply house for "a hundred pounds of Government-graded Choice Steer" and be reasonably sure of getting the quality he wanted.

Today's housewife can look to this buying agent as the pioneer consumer to get Government-graded meat. It wasn't long before fellow members of the beef-buying profession—buyers for hotels, clubs, restaurants—took to the idea and began to specify "Government-graded meat" when they bought.

In the early days of trading in meats, big buyers bargaining in

Reprinted by permission from The Cattleman, October, 1940

the market began to designate the type of meat they wanted according to the region where the animal was raised. "Native" beef, for example, was beef from the Corn Belt. From the Range States came "Western" beef. Gradually there grew up variations in these designations, such as "Choice," "Good," "Medium," and "Common Westerns."

Designations such as these, it turned out, were about as scientific as looking at the moon through a pair of opera glasses. But this was nothing compared with what happened when cattle originating in the Range States were shipped off to the Corn Belt for feeding. Meat designations, as used by the trade, become confused to the point of complete uselessness. Furthermore, they lacked even common acceptance. Meat called "Good Native" by one packer was "Choice Western" for another. There was nothing systematic or scientific in the way beef was described between traders or between regions. And what was true of beef was true also of other kinds of meat.

Ranchmen and packers began to grumble and complain. "There ought to be a law," they argued. Researchers at the Agricultural Experiment Station of the University of Illinois, heeding the grumbling, tried to straighten out the chaos. In 1902, they listed all existing meat designations, defined and interpreted them. The results of the study got tucked away in a bulletin.

Flip the pages of the calendar 24 years—to 1916—and you reach another significant moment in the history of meat graders. That year, the U. S. Department of Agriculture pulled the Illinois study out of the files and used it as a starter in setting up its first tentative standards for classes and designations of beef. These designations were not intended to be quality guides to consumers, but were planned merely to simplify the Government's job of market news reporting. Establishment of these trail-blazing beef designations was followed in short order by tentative designations for lamb, veal, mutton, and pork.

Here were standard descriptions that had many more elements of importance than had the old trade designations for meat. They took account of such things as conformation and fat distribution, the appearance of the meat itself, as well as the section of the country where the animal was brought up. But they were never stamped on meat carcasses. They were used only in reporting market supplies and prices.

In 1923, when the buyer for the steamship firm decided to order his meat by the Government's grade designations and so

became the first consumer to use this Government service, the need for reexamination of the grade designations became more acute.

Grades were not actually examined into, however, until three years later—in 1926. As a result of hearings, revisions in the grades were made. These were subsequently issued as official United States standards for grading beef, lamb, veal, mutton, and pork. Despite the fact that grades were now available to consumers if they asked for quality labeled meat, it was producers, not consumers, who got behind grading and pushed it along.

Red-letter day in the history of meat grading is May 2, 1927. Early that morning officials of the Department of Agriculture, grade stamps in hand, walked into packing plants in seven of the Nation's large cities, and quality grading of meat as we know it today was underway.

At first, grading was restricted to "Choice" and "Prime" grades of steer and heifer beef. By January, 1928, the experiment had become successful enough to include the "Good" grade. A little later the service took in all grades of beef, lamb, veal, and mutton of all classes.

But it was over a year before experimental grading and stamping became a regular service of the Department of Agriculture, put on a fee basis to cover its cost.

Here the story for beef grades sidetracks into its own separate chapter. From their earliest beginnings, grades for beef had always been based on a triple set of standards, one for each class—or type—of beef, such as steer, heifer, and cow. That meant there was a "choice" grade for steer, for heifer, and for cow, a "good" grade for each class of beef, and so on down the line. Those class differentiations were carryovers from the days when retailers bought beef in terms of live cattle. A bulletin of the Department of Agriculture explains this situation this way: "Except in the case of the very young of all species, sex condition affects the character of the carcass, and this in turn influences the prices which a given class will bring, as compared with the price received for another class. For instance, a steer beef carcass is more desirable than a cow beef carcass of the same grade hence, steer beef sells at a relatively higher price than does cow beef of a comparable consumer buying Government-graded beef grade."

More simply this means that a consumer buying Government-graded beef was expected to know that the same grade in the three classes of beef did not always mean the same quality. Having a triple standard was use-

ful to traders—the wholesalers and big buyers—because the amount of meat obtainable from a carcass varies with the sex and age of the animal. But for the ordinary household consumer, it muddled the whole picture. It meant the equivalent of carrying along a dictionary of meat grades every time she bought, if she was to know accurately what she was getting.

The danger was always present, too, that unscrupulous dealers would palm off a "Choice" cut of heifer beef, when the consumer asking for the "Choice" grade meant the best grade available, or "choice steer."

To guard against such consumer confusion, last year the Department of Agriculture made a new proposal to producers, consumers, and meat packers. Why not do away with class designations altogether, so far as the domestic consumer is concerned but show them on grading certificates, the Department asked. That would give dealers the information they need, but eliminate a designation consumers don't need. Quality marks would then boil down to five simple grade names: *Prime, Choice, Good, Commercial, and Utility.* That—and no more—would be all the consumer would have to remember when she asked for Government-graded beef.

Packers, dealers, consumers took to the idea at conferences called by the Department of Agriculture for discussion of the plan. The simple fact that what consumers wanted was a grade designation on a cut of beef was the keystone of the plan. Such a grade stamp would improve their chances of getting the quality they pay for.

And there you have chapter 3 in this thumb-nail history which brings the story down to the present.

Today you can buy Government-graded beef that is graded according to this "single standard." All you have to remember are these grade names and their place in the quality scale of beef from top to bottom: *Prime, Choice, Good, Commercial, and Utility.*

Beef is graded on the basis of quality, finish, and conformation.

"Quality" is defined as color, texture, grain, and degree of marbling of the beef.

Finish is judged on the quantity of fat, its color, character, and the way it is distributed in a cut of beef.

Conformation is the general "build" and appearance of the beef. For consumers, its importance lies in the fact that a cut rating high in conformation has a large proportion of edible meat to bone.

Here is what the beef grades as now used mean:

Prime: The highest grade of beef, but available in very limited quantities, usually in late fall and winter. Domestic consumers rarely see it. Used almost exclusively by hotels, restaurants, clubs. Produced only from specially fed steers and heifers which represent the highest degree of perfection in breeding.

Choice: Highest grade of beef commonly available to consumers. Marketed year-round in the Middle West and the East, and available in limited quantities in the West. Usually cuts are relatively fat and require considerable trimming. Produced from steers and heifers specially nourished on concentrated feed.

Good: This grade meets the needs of consumers who have small food budgets and want the best quality they can get for moderate prices. Sold in all sections of the country throughout the year. Carries enough fat for average needs, but not enough to require heavy trimming before serving. Produced largely from steers and heifers fed intensively on concentrated feed for varying lengths of time. From this grade down the manner of cooking requires attention. Tougher meats can become more tender with proper cooking.

Commercial: For consumers with tight food budgets able to buy beef only if prices are below average. Has very little excess fat. Produced from steers and heifers and relatively young cows fed largely on grass or roughage, and fed concentrated feed for only a short time.

Utility: Lowest Government-graded meat usually available to consumers. This grade obviously includes meats which are not tender but can be made palatable by careful and imaginative cooking. It should be sold at the lowest price. Produced from steers and heifers fed largely or entirely on grass or roughage and from cows producing beef deemed suitable for sale in the retail market.

Grades for other kinds of meat remain unchanged. For veal, lamb, mutton, they are: *U. S. Prime, U. S. Choice, U. S. Good, U. S. Medium, and U. S. Plain. Medium* and *Plain* for these meats correspond to *Commercial* and *Utility* grades for beef.

Neither Government nor producers claim that meat grades as they exist today have reached final perfection. Experience has shown, however, that present grades are a fairly dependable guide to quality for consumers and are a great advance over grades that vary with the house that sells the meat.

The grading service today reaches into all important meat packing centers in the country. Beef sold to consumers bearing the Government grade mark represents about 10 per cent of the

total amount of meat Federally inspected for wholesomeness; the percentage is slightly smaller for other kinds of meat.

Meat grading—as has always been the case—is voluntary. Any retailer can get Government-graded meat by ordering it from his wholesaler. That means it's up to the consumer to ask for cuts that are Government-graded if they are not available in his local market.

Grading is done by trained experts who must have had at least six years of experience in meat grading, meat buying or selling before they are allowed to apply the Government grade to meat. In addition they must pass satisfactorily a 12-month probationary period. These stiff qualifications are set up to keep the grades as uniform as possible.

Service charge for grading is $2 an hour. This is charged to the packer to make the service self-supporting. On the average, 50 carcasses are graded in an hour. The cost averages about three-hundredths of a cent a pound. That cost of grading is too small to make a difference in the cost of meat to consumers.

Don't confuse the "round purple stamp" of meat inspection with the grade mark. The round purple stamp is required by law to be put on all meat crossing State lines. It is an indication that the meat has been inspected and passed by the U. S. Government, and that it was safe for human food and clean when it left the inspected establishment.

Grade marks appear over and over again on the whole length of any meat carcass, as *U. S. Choice, U. S. Good,* or whatever the grade might be. You should be able to find the grade mark without and difficulty on all cuts claimed to be Government-graded.

78% of All Poultry Diseases Can Be Controlled

Condensed from The Poultry Item

CONTRARY to popular opinion, it is not diseases such as fowl paralysis and leukemia which are most prevalent throughout the United States today and cause the 150 million dollar loss, but the everyday, generally understood diseases. Bowel troubles, pneumonia, unabsorbed yolks and coccidiosis in chicks, and coccidiosis, worms and lice in older fowls.

Too much familiarity with these diseases actually has led to negligence. If poultrymen would practice the available measures of control, a large degree of prevention could be attained and the losses due to disease reduced.

In order to obtain a true picture of the poultry disease situation, Dr. Salsbury's Laboratories made an analysis of the diagnostic records of 6,404 chickens, turkeys, water fowl, and pigeons of all ages sent in for free examination during 1939.

Inasmuch as these specimens came from 42 states and the District of Columbia, it was felt that they would constitute a fairly representative sample, and any tabulation of the disease conditions found, would give a true cross-section of the poultry disease situation.

Since these specimens were unsolicited and were received during the immediate past year, the conditions found probably represent the most up-to-date survey of its size and scope available to the poultry industry today. While federal aid has been extended in establishing laboratories for the study of the poultry disease problem, emphasis thus far has been placed upon such conditions as fowl paralysis and leucosis. It seems that a larger field of endeavor in the more common diseases is revealed by this survey.

A classification of all diseases constituting more than one percent of the total is included in the accompanying table with a miscellaneous grouping of prolapse, injury, ruptured oviduct, dropsy, botulism, peritonitis, toxemia, etc. The percentages of all diseases cannot be totaled inasmuch as more than one disease often is found in the same specimen.

Poultry diseases may be studied from the viewpoint of the pathologist who is interested merely in finding out through a post-mortem examination what it

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was that ailed a chicken. The practical poultryman would rather have the viewpoint of the clinician or physician who thinks in terms of treating an animal for a disease rather than killing it merely to find out what disease it had.

Poultrymen may well stop to consider that a chicken is not replaced cheaply, for in addition to her inventory value of at least 75 cents, it also will cost at least that much to replace her with another pullet. We cannot afford to continue losing hens at the rate of 18.8%, or one out of every five, which was found to be the average flock mortality in ten Midwestern states recently surveyed by C. M. Ferguson, of Ohio State.

That is why the accompanying chart represents an attempt to do more than merely list the diseases in the order of their prevalence; it presents a program of disease-control based upon standard measures available to every poultryman, with conservative estimates based upon actual field observations of the degree of control available for each disease listed.

Aside from the inherited ability to withstand disease on the part of the fowl, there are four factors of disease control available to every poultryman. None of these is self-sufficient; each supports the other and without all of them a well-planned disease control program will be incomplete and therefore ineffective.

Applying a uniform yardstick of measurement for disease control, the figure 100 was used to apply to those diseases for which there was the greatest degree of control available. All other diseases were rated according to the degree of control available in each, and thus a basis for estimating the total degree of preventability in all diseases was found.

After applying this universal yardstick of preventability to the poultry disease situation, a very hopeful picture was revealed, quite in contrast to the gloomy outlook that has been depressing the horizon of the poultry industry.

A study of the table will reveal that the diseases which are most prevalent can be controlled to the greatest extent, using the known measures and means as outlined in the chart.

Nearly all diseases will show some response to treatment but the degree of response will vary with the advance of the disease and the timeliness and thoroughness with which the treatment is applied. Sanitation is no cure-all, for diseases often appear in the cleanest of houses and on a new range.

Preventive treatment is most effective and this includes vaccin-

ating for the five diseases listed in the table; namely, roup and colds, cholera, typhoid, fowl pox and laryngotracheitis. Fowl pox is, of course, the disease for which vaccination most commonly is applied, but the others shown are subject to control to a varying extent as shown by the percentages given.

Taking the case of cholera, as an example, we can show the relationship of corrective medication plus sanitation and management. Santitation cannot be relied upon to prevent outbreaks of cholera, for it will appear on the cleanest of premises without warning and in spite of all possible precautions. Hence 5% prevention is all that can be claimed for sanitation as a measure of control, but timely and effective medication has been known to reduce mortality at least 15% as conservatively estimated in the table.

Two investigators in Long Island, New York, vaccinated 45,411 ducks with Cholera-Typhoid bacterin and they had a loss of only 4.1%; while the control group numbering 5,761, purposely left unvaccinated, suffered a loss of 29.4%. That is why 80% control attributed to vaccination in the table is considered very conservative.

With the adoption of the Federal Food, Drug, and Cosmetic Act, the consumer has placed an increasing confidence in bacterins, medicines, and vaccines manufactured by reliable poultry service laboratories, and as a result poultrymen have accepted these products to support their sanitary programs. While specific remedies in many instances are unavailable for treatment of diseases, these products can be relied upon to aid the poultryman in accordance with the claims found on the labels of the containers in which they are sold.

It was found that in 86% of the growing stock and adult fowl that were sent to Dr. Salsbury's Laboratories, an inflammation of the intestinal tract was found, 59% were anemic, and 52% were badly emaciated. While enteritis, anemia and emaciation were not specific diseases, these symptoms are of tremendous importance because they reduce the marketability of the fowl to a point where it must be rejected as a cull.

A chronic inflammation of the intestinal tract reduces the efficiency of that organ in the digestion and assimilation of food. If the chicken is anemic, as is often the case after severe attacks of parasites, there is insufficient hemoglobin or red blood cells to carry this food throughout the blood stream. Chronic conditions finally reduce the chicken to a state of emaciation and thus we have a loss that is greater than

the actual mortality of flocks—the loss due to culling.

The encouraging conclusion that can be made from this impartial survey is that the diseases largely responsible for the $150,000,000 loss in the poultry industry have an estimated potential preventability of 78%.

A preventability of 78% is considered reasonable for all the diseases found in this survey using all the known methods of control available to the poultryman. This estimate is quite conservative, certainly not too optimistic.

Scientific medication has its place in a well-planned disease prevention program and if the poultryman will apply the means of control outlined with the degree of thoroughness and timeliness that is essential for effectiveness, he will be able to reduce his share of the annual loss due to poultry diseases.

DIAGNOSIS OF LOSS

An analysis as shown by the diagnostic records of a commercial laboratory covering 6,404 baby chicks and adult chicken specimens during 1939 and the estimated means of prevention.

Disease Condition	Percentage of Prevalence	ESTIMATED PREVENTABILITY BY: Testing to Remove Carriers	Vaccination to Stimulate Immunity	Corrective Medication and Feeding	Sanitation and Management	Total Potential Preventability
1. Chick Bowel Troubles	89.98%	30%	0%	25%	25%	80%
2. Chick Pneumonia*	54.03	50	0	25	25	100
3. Unabsorbed Yolk	35.80	10	0	10	40	60
4. Pullorum	19.46	90	0	0	0	90
5. Omphalitis	6.00	0	0	0	100	100
6. Chick Bronchitis	1.00	0	0	25	45	70
7. Coccidiosis						
Chicks up to 7 weeks	18.53	0	0	50	25	75
Growing fowl, adults	42.05					
8. Roundworms and Capillaria	32.70	0	0	80	20	100
9. Cecal Worms	32.70	0	0	80	20	100
10. Tapeworms	23.42	0	0	25	25	50
11. Lice	31.58	0	0	100	0	100
12. Roups and Colds	25.38	0	50	25	10	85
13. Laryngotracheitis	1.48	0	100	0	0	100
14. Pox	5.48	0	100	0	0	100
15. Cholera	15.94	0	80	15	5	100
16. Typhoid	14.43	0	80	15	5	100
17. Pullorum						
Chicks up to 7 weeks	19.46	90	0	0	0	90
Growing fowl, adults	5.21					
18. Tuberculosis	3.38	90	0	10	10	100
19. Leucosis and Tumors	9.45	0	0	0	10	10
20. Neurolymphomatosis	3.41	0	0	35	35	70
21. Non-Specific Paralysis	15.77	0	0	50	25	75
					Total Average Preventability	78%

*Over fifty percent is estimated due to pullorum.

Chick bowel troubles, as they are commonly called, include the various forms of enteritis, or intestinal inflammation. Since pullorum disease was partly the cause of bowel troubles, as well as unabsorbed yolk and chick pneumonia, it should be possible to attain the preventability shown in the first column after these diseases by testing the parent stock.

At the present time, vaccination can be utilized for only five of the diseases shown, but timely and effective medication is to a varying extent estimated to yield the results shown in column three. Corrective feeding, when applied to nutritional deficiencies, includes adequate vitamin fortification, balanced rations, and proper mineral balance to avoid such conditions as perosis, or slipped tendon.

Sanitation includes disinfection and fumigation, and management implies the necessary precautions to avoid infection. With a combination of these methods of disease control it is reasonable to assume a total potential preventability of 78% as shown in the final column.

Since more than one disease condition often is found in the same specimen, the total of the prevalence column cannot be calculated. Leucosis and all tumors are not necessarily grouped because of any relationship, but for convenience in classification. Specimens with symptoms of paralysis but with no nerve enlargement were classified under non-specific paralysis.

FOR THE FARMER'S LIBRARY

These books are recommended as outstanding in their field:

Beef Cattle—By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Son, Inc. $4.00.
(See Farmers Digest, November, 1939)

Beekeeping—By Everett Franklin Phillips, Professor of Apiculture, Cornell University. Published by the Macmillan Co. $4.00.
(See Farmers Digest, July, 1940)

Breeding Your Own, or Raising Colts for Pleasure and Profit — By Clarence E. Bosworth. The Derrydale Press ($10.00). A book suitable for the breeders of hunters' and saddle horses.

Conservation in the United States—By Gustafson, Ries, Guise and Hamilton. Comstock Pub. Co. $3.00.
(See Farmers Digest, July, 1940

Dairy Cattle and Milk Production—By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Div. of Dairy Husbandry, Univ. of Minnesota. Macmillan Company. $3.60.
(See Farmers Digest, February, 1940)

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.
(See Farmers Digest, October, 1939)

Farm Meats—By M. D. Helser, B.S.A., M.S., Prof. Animal Husbandry, Iowa State College. Macmillan Co. $2.90.
(See Farmers Digest, January, 1940)

Farm Records—By John A. Hopkins, Ph.D., Asso. Prof. of Eco., Iowa State Col.; pub. by Collegiate Press. $2.50.
(See Farmers Digest, October, 1940)

Livestock and Poultry Diseases—By W. A. Billings, Asst. Prof. of Vet. Medicine, Univ. of Minnesota. Macmillan Co. $3.50.
(See Farmers Digest, June, 1940)

Poultry Husbandry—By Morley A. Jull, Prof. of Poultry Husbandry, Univ. of Maryland. McGraw, Hill & Co. $4.00.
(See Farmers Digest, July, 1939)

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. Macmillan Co. $3.75.
(See Farmers Digest, September, 1939)

Poisonous Plants of the United States — By Walter Conrad Muenscher, Prof. Botany, Cornell. Macmillan Company. $3.50.
(See Farmers Digest, November, 1940)

Sheep Production— By Levi Jackson Horlacher, B.S.A., M.A., Asst.to Dean, Col. Ag. Univ. Ky. McGraw-Hill Co. $4.00.
(See Farmers Digest, September, 1940)

Soil Conservation—By Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Department of Agriculture. McGraw-Hill Book Company, Inc. $6.00.
(See Farmers Digest, December, 1940)

Vegetable Crops—By Homer C. Thompson, Ph.D., Prof. Veg. Crops, Cornell Univ. Pub. McGraw Hill Book Co. $5.00.
(See Farmers Digest, May, 1940)

For the convenience of our readers, books listed may be purchased through this Department. Address C. Leavitt Dyer, Farmers Digest, Ambler, Pa.

Soil Conservation Bulletins

To Hold This Soil
Miscellaneous Publication No. 321, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 45c

Terracing for Soil and Water Conservation
Farmers' Bulletin No. 1789, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 10c

What is Soil Erosion?
Miscellaneous Publication No. 286, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 15c

Strip Cropping for Soil Conservation
Farmers' Bulletin No. 1776, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 5c

The Land in Flood Control
Miscellaneous Publication No. 331, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 10c

Conservation Farming Practices and Flood Control
Miscellaneous Publication No. 253, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 5c

Soil-depleting, Soil-conserving and Soil-building Crops
Leaflet No. 165, Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 5c

Soil Conservation Districts for Erosion Control
Miscellaneous Publication No. 293, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 10c

Soil Defense in the Northeast
Farmers' Bulletin No. 1810, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 15c

Erosion on Roads and Adjacent Lands
Leaflet No. 164, U. S. Department of Agriculture
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